

April 24, 1961

Pilot Report:

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Aviation Week

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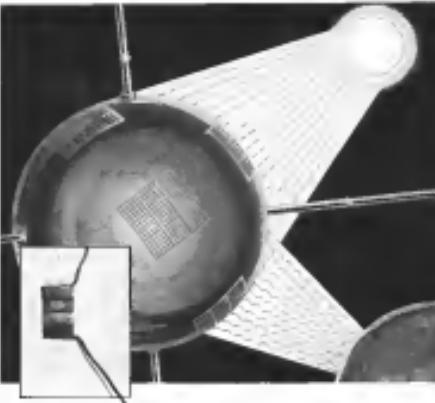
AVIATION CALENDAR

Mr. 24—Electronic Components Conference, Radio Engineers, 10th Hotel, Bay Pines, Calif.
Mr. 25—17th Annual National Forum, American Helicopters Society, Sheraton Hotel, Washington, D. C.
Mr. 25—Nuclear Applications in Space Conference, America Rocket Society, Oak Ridge National Laboratory, Griffin, Tenn.
Mr. 45—5th Annual Symposium, Research Institute in Electronic Materials of Radio Engineers, Merrimac, Mass., Atlantic City, N. J.
Mr. 48—Fifth Annual Symposium on Current Theory, Institute of Radio Engineers, University of Illinois, Urbana.
Mr. 49—8th Bi-annual Electronic Symposium, University of Michigan, Farmington Hills, Mich., March 1969.
Mr. 5—10—National Aerospace Electronics Conference, IEEE, Miami and Broward Hotels, Miami, Fla.
Mr. 12—15—Annual Meeting, Airport Owners Council, Hotel, Miami Beach, Fla.
Mr. 16—19—Annual Meeting, Society of Civil Engineers, Joint Session, "Advanced Concepts of Airport Systems," Miami, Fla.
Mr. 21—23—Western Joint Computer Conference, University of Colorado, Boulder, Colo., March 1969.
Mr. 29—31—Spring Meeting, Society of Instrumentation Engineers, Sheraton, Franklin Hotel, Philadelphia, Pa.
Mr. 31—Apr. 1—1969 College of Aerospace Sciences, University of Maryland, University of Maryland, 1010 Killian Street, Park Hall, Bethesda, Md.
(Continued on page 6)

Assessing Social and Family Function

April 24, 1961.
Vol. 24, No. 13

Principles. Please have some copy of *Principles of Psychology* by William James, and also a copy of *Principles of Education* by John Dewey.



Taming the sun's energy to solar battery needs

Bausch & Lomb optical/electronic/mechanical capabilities increase cell efficiency

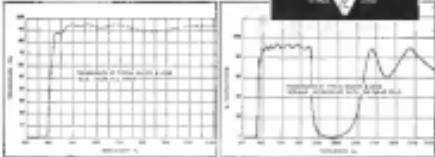
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Barbach & Lomé coatings enhance the efficiency of solar cells by allowing them to operate at cooler temperatures. “20°in” (see typical curve) coatings selectively absorb the radiation needed to energize the cell. The “Red-blues” coatings cause the hot solar-red radiation back into space (see typical “red-blues” curve).

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AVIATION CALENDAR

(Continued from page 5)

June 10-12—National Armed Forces Day Dinner, National Park Hotel, Washington, D. C.
June 12-14—Mid-Atlantic Air Fair, Municipal Airport, Wilkes-Barre, Pa.
May 15-16—Region One Air Traffic Control Area Convention, Hotel Bedford, Boston, Mass.
May 17-18—Aviation Fire Safety Seminar, Technical Services, National Fire Protection Assn., Hilton Hotel Hotel, Detroit, Mich.
May 18-19—National Symposium on Maintenance Theory and Techniques, R.E. Blattner Park Hotel, Washington, D. C.
May 19-20—19th Annual National Conference Society of Automotive Winter Engineers, Statler Hotel, Akron, Ohio.
May 23-24—National Telecommunications Conference, Statler-Town Hotel Chicago, Ill.
May 23-24—FAM National Symposium on Civil Communications, Seminar of National Fire Protection Assn., Boston, Mass.
May 28-June 4-24th French International Air Show, Le Bourget, Paris, France.
May 27-30—11th Annual Wright Memorial Color Meet, Society of Dyers, Dayton, Ohio.
May 29-June 1—University of Michigan Seventh Annual Radio Symposium, Ann Arbor, Mich.
June 2-8—12th National Maintenance and Operations Meeting, Reading Aviation Services, Inc., Reading, Pa.
June 11-12—Management and Marketing Institute of the American Society of American Rocket Society, Ambassador Hotel, Los Angeles, Calif.
June 13-17—TMS Meeting, Aviation Division and Maintenance Assn., Denver, Colo. (AIAA, American Inst. of Mfg., etc.)
June 14-16—19th Annual Conference, Production Processing and Production, Institute of Rollers Engineers, Sherman Hotel, Philadelphia, Pa.
June 23-25—Eight Annual Symposium on Control and Data Processing, Division Applied Institute, Wilson Auditorium, Edina Park, Calif.
June 26-28—National Convention on Military Electronics, Institute of Radio Engineers, Meeting House, Washington, D. C.
June 26-28—Special Test Conference, Vol. 1, Institute of Electrical Engineers, Aerospace Transportation Committee, Benjamin Franklin Hotel, Philadelphia.
June 28-July 1—Annual Meeting, Institute of Surveyors, Williamson Inn, Williamson, Pa.
July 25-26—16th International Trade Fair and Aviation Exhibitors McCormick Place Exposition Center, Chicago, Ill.
Aug. 12-15—Western Electronic Show and Convention, Civic Palace, San Francisco, Sept. 6-9—19th Flying Display and Relationship, Society of Naval Aviation Constructors, Pensacola, Fla.
Sept. 6-8—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.
Sept. 13-14—National Convention, National Aerospace Assn., Worcester, N. Y.
Oct. 27-28—International Astronomical Congress, Washington, D. C.



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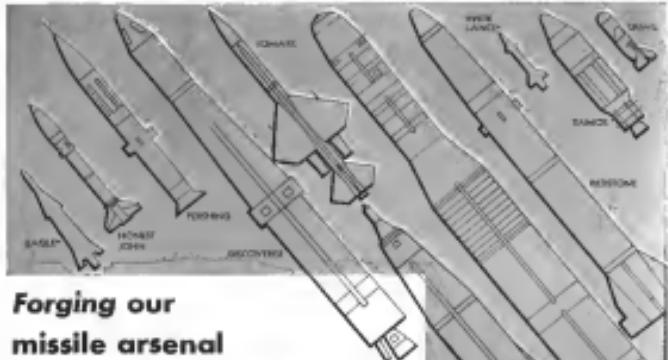
Just as runway lights establish the boundaries of a landing strip at night... and the pilot relies on electronic eyes to see through clouds and darkness... a submarine can be fully oriented to the vast depths of the sea by a continuous set of signals. Norden's compact analog display in the submarine's control room reveals on a single screen every key parameter: pitch, roll, heading, distance and bottom position. This sophisticated system utilizing advanced television and computer techniques, was developed for the Navy's Bureau of Ships. From concept to hardware in less than 18 months. With minor modifications, the display is applicable to aircraft.

This is just one of several important programs at Norden involving advanced television, radio, digital computing, and digital control systems. The compact analog display, passing out the runway beneath the sea, demonstrates Norden's primary mission, EXCEEDING MAN'S CAPABILITIES.

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Some types of enemy targets benefit from Video Analysis (left to right): AF-8 Automatic Pilot for light aircraft, Army's BACON/AT missile system, Navy's Mark 15 Gyro-Compass, USAF's RIM-66 Nuke Radar System. (Courtesy photos for *Aviation Week* magazine illustration)

SPERRY



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Kinetics switches are used in missiles for many power requirements, range safety systems, deflection circuits, telemetry systems, battery switch and a multitude of other uses. Switches are now being supplied for the major intercontinental ballistic missile program, the land-based and one submarine launched strategic missile range infarate missile, two intermediate ballistic missile programs and three space vehicles.

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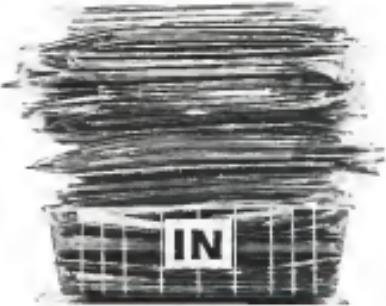
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9. Don't know
10. Don't care
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第六章 会议与接待 会议与接待 17

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EDITORIAL

The Too Familiar Pattern

With the recall of Russian-bait Stalins tanks only 90 mi from Miami and Cuban dictator Castro's threat to stalk Florida airfields with Korean-bait MiG jet fighters, it may be an appropriate time to look around the world to see just what has happened in critical areas since the January "thaw" in US-Soviet relations at the outset of the Kennedy Administration.

At that time, some people bailed the return of the USAF B-57B bombers as raising of intense local tensions and evidence of Soviet willingness to participate in significant negotiations aimed at salvaging a troubled world. Few people noted that the USAF B-57 crew had been shot down illegally over international waters, that four of the six men had been manhandled by the Soviet fighter pilots and that the two survivors had been held illegally in Soviet jails for many months.

It is an old Soviet technique to gain concessions from its opponents by agreeing to stop doing something it had no right to do in the first place.

Russian Stalling

How has international tension eased since that gutting? Almost every trouble spot in the world has boiled over under Soviet stimulus. In Laos the Soviets are playing an old, familiar game that should be pretty clear to students of the Korean and Indo-China wars. They started a Russian-occupied station of Laos and are now isolating the U.S. and its allies with "ceasefire" negotiations while their poor in military supplies and resources in position has a million coup de grace. Only when they have attained their goal of dismantling Laos will the Soviets agree to anything. Then an agreement will only serve to raise their aggressive goals. Over again the perimeter of international Communism will be significantly extended.

We are getting another sample of this familiar pattern of Soviet negotiations in Geneva where the majority of earliest talks over a nuclear test ban is believed only by the ingenuity of the Soviet delegates to originate no objection to any concrete steps in this direction. In the meantime, critical nuclear weapons development programs in this country are being blocked by our self-imposed voluntary test ban. It will be difficult to increase the warhead yield of Palomar and Minuteman ICBMs without further testing because of the inherent size limitations of these weapons. It will also be difficult to develop the full range of multi-payload tactical nuclear weapons for battlefield use without further testing.

The original international campaign against nuclear testing was stimulated by the Soviets on the ground that

fallout contamination would pollute the world. The fact that most types of nuclear testing can now be carried out underground where there is no fallout has somehow been obscured by the fog of Soviet propaganda. It must be evident to all concerned that the Soviets have no real interest in either disarmament or nuclear test ban but are simply shifting in any manner they can to delay U.S. weapon development programs that pose a serious threat to their continued plan for aggression.

Feint and Thrust?

With the pots boiling in Laos and Cuba, we wonder how long it will be before the Soviets stir up another trouble spot to stretch our resources before making their next move. Will they get the Berlin pot boiling again before making another major thrust to extend their perimeter into Iran, for example? Most Americans have forgotten that Iran was one of the few places in the post-war world where the Communist perimeter was really back and aggression effectively stalled. But the Soviets certainly remember and can be expected to keep Iran on their list for future action. Soviet troops moved into northern Iran shortly after World War II and moved south again after blunt warnings by former President Harry Truman. But in those days we had a monopoly on both the atomic bomb and the aerial delivery system required for reaching long-range targets and this apparatus was language that dictated Stalin's undercutting.

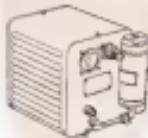
Communist Encroachment

It is high time that the American people understand the pattern that is being developed with the sole purpose of extending the perimeter of Communism and eventually strangling freedom wherever it still persists.

We agree with President Kennedy that military leaders should avoid public discussion of foreign policy. But we strongly desire that open discussion of the increasingly acute problem of Soviet aggression should be avoided for fear of "frightening" the Soviets and spilling the probabilities of international negotiation. This latter policy serves only the Soviet purpose and again will kill the American people into a false sense of security. In contrast, even events in Laos, Cuba, Geneva, Berlin and outer space in the past few weeks should convince every American of the reality of the menace we face and the need for exerting a national effort to oppose it that is unprecedented in our history in its nature.

—Robert Holt

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GROUND
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AC/DC DIAPHRAGM COMPRESSOR, CDA-10000-4. Positive air output of 1000 cu ft/min (3000 cu ft/min at 1/2 FSD rate), absolute pressure. Weights 10 lbs. with motor and compressor 100 lbs. 1000 cu ft/min at 1/2 FSD rate. 1000 cu ft/min at 100% load. 1000 cu ft/min at 100% load at 100°F. 1000 cu ft/min at 100°F.

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WHO'S WHERE

In the Front Office

Robert E. Lewis, president and chief executive officer and a director of Federal Electronics, Newark, Conn., has been elected chairman of the board of directors of Federal Electronics. Lewis will remain chairman.

H. E. C. de Cheneau, president, D. Soper & Son (Canada) Limited, Montreal, Canada, has de Cheneau as managing director of D. Soper & Son, London Eng., and of D. Soper & Son, Ltd., London Eng.

Brace C. Johnson, president and chief executive officer, a director of Fairchild Engine and Airplane Corp., Indianapolis, Ind.

Dr. Stuart T. Ross, vice president research and engineering, Brooks & Ferrers, Inc., Detroit, Mich.

Dr. Michael M. Pines, a director of Mita Electronics, Los Angeles, Calif., Dr. Pines is a professor of Electrical Communication at Massachusetts Institute of Technology.

Ital Corp., Waltham, Mass., has formed Ital International by joining two companies, Italoservizi (International) Co. and Italoservizi Technological International, and has appointed the following officers: John R. Carter, president; Michael M. Hubbard, vice president and director of research; Dennis E. MacEachern, vice president and chief scientist; Dennis H. Taylor, vice president and director of engineering.

Robert H. Roy, a director, is with Anacostia, Baltimore, Md. Mr. Roy is the Dean of the College of Engineering, Johns Hopkins University.

Frank E. Osborne, president, E. H. Hailey & Son, Los Angeles, Calif., succeeded B. H. Hailey as chairman.

Kenneth M. Miller, vice president and general manager, Battelle Seattle, Los Angeles, Calif., a division of Battelle.

William H. Moore, vice president, Vitek Corp., Division of Electronic Industries Association, Washington, D. C.

Ralph H. Eason, a vice president of North American Aviation, Inc., Los Angeles, Calif., has been promoted to the Los Angeles Division, succeeding Raymond H. Rice, on leave of absence.

Edwin S. Weeks, vice president and chief administrative officer, Cleveland Instrument Co., Cleveland, Ohio, a subsidiary of the E. F. Johnson Co., Cambridge, Mass.

James S. Lee, aerospace executive vice president of United Aircraft International, has been promoted to president of the Pratt & Whitney Aircraft Division of United Aircraft Corp., East Hartford, Conn.

Gen. H. Hanson and Walter E. Brown, vice presidents of Boeing-Latrobe Corp., Latrobe, Pa., have been promoted to the Boeing Space and Field Services Targets and Controls Division.

Dr. Leonard S. Shatzberg, chief scientist of the United States Air Force according to Dr. Alexander F. Rice, who will return to Cornell Aeronautical Laboratory as vice president of research and development and is director of the Applied Research Laboratory of Schenectady, N.Y. Dr. Shatzberg will be succeeded by Dr. Robert F. Fink, director of the Applied Research Laboratory of Schenectady, N.Y.

Col. John E. F. Bond, executive officer of Radiation Division, Huntsville, Ala., and Lt. Col. Stanley L. Nyhus, assistant project manager.

(Continued on page 125)

INDUSTRY OBSERVER

► Air Force Space Systems Division has asked Martin to establish stability of its definitive configuration for the advanced Space E-6 services, capsule with solid-state, wind tunnel tests at National Aerospace and Space Administration's Glenn Research Center. Preliminary E-6 development is being pushed rapidly at General Electric's Missile and Space Vehicle Department. Capabilities projected for pressure recovery over half-life are not expected to be met operationally before early 1963.

► Contractors interested in bidding on the Apollo spacecraft project will be invited to a conference to be held July 15 by NASA. Current study contractors are to report May 15, and the results will be used to write specifications present at the July meeting.

► USAF once has decided to have Project Boeing build the missile boost system test, as the test contractor already chosen—Convair and Space Technology Laboratories (APR 19, p. 36). An Air Force originally planned a third study but competing companies have been told these will be none. Funding for the project also may be reduced as a result of Advanced Research Projects Agency USAF differences over whether research and development goals should be shared in the near future.

► Air Force will substitute nitrogen tetroxide for hydrazine, roll forming nitide and as the oxidizer in future Agnew Agena B flights. Fuel remains monomethyl dinitrohydrazine (UDMH). Switch was made because of nitrogen tetroxide's higher specific impulse when burned with UDMH and because its greater density provides more oxidizer per pound.

► First launch of USAF-Martin Titan II test vehicle directly from a site tentatively is scheduled from Vandenberg AFB May 3. Site Launch Test Facility is about 140-ft deep and has dual launch which start down and then up to blend off exhaust gas. Solid and exhaust ducts are lined with heat-reflecting noise-dampening material which is designed to minimize vibration effects which otherwise might severely damage or destroy the missile in flight, the info says.

► Means of defending against orbital offensive and environmental hazards which space vehicles might incur in near earth or while maneuvering in interplanetary trajectories are being analyzed by Air Force's Aerospace Systems Division in anticipation of the hazards of future tactical missions in space.

► New instrumentation type of spectrometer for analyzing orbital radiation, with a sensitivity 1,000 times greater than conventional devices, has been developed by Black Associates, Cambridge, Mass., for Air Force Cambridge Research Laboratories.

► Proposals for design study of Prospector, a mobile, self-launching heat vehicle, probably will be submitted to NASA's Jet Propulsion Laboratory next month or early in June.

► Douglas is proposing analysis of a ground effect vehicle to offer to Naval Research. Douglas says the vehicle is expected to have commercial possibilities along with its military tactical application.

► Feasibility study of converting voice to picelike waves through alternate encoding and switching will be supported by the Air Force Aerospace Systems Division. Aimed at providing waveforms for space crews, this may reduce approach calls for using a moving heat source to melt small areas of a silicon diode's surface, the info says.

► Navy's David Taylor Model Basin plant to use the staged hydrodynamic research facilities at NASA's Langley Research Center for research and development programs concerning hydrofoil air cushion vehicles, hydrofoil planning catamaran, steep-takeoff-and-landing aircraft, reentry and underwater rockets.

Washington Roundup

Agitation for Overtime

Latest signs of a growing impatience with the relative U. S. position in space exploration include agitation in some top National Aeronautics and Space Administration officials for a longer work week—48 hr at first and later 40 hr.

Since the agency was formed two and a half years ago, key management and technical personnel have often worked much longer weeks than that. But legal notice now—less than four months ago—has prompted some to argue that it is time to end the effect of the management's overtime that it is in.

NASA would need more money in salaries and expenses to switch the board to longer work weeks, technicians, scientists and others on the job for more than 40 hr. Meanwhile, Congress continues to insist that agency should follow a series of agency and the Kennedy Administration is continuing the Eisenhower policy of guarding top priority—which also means unlimited overtime money—only to the Mercury and Gemini programs.

The three-year-old argument that the U. S. lag in space exploration is not important because of the U. S. lead in space science no longer is being well on Capitol Hill. Although administration could not down-again if Russia does not make another manned flight soon, there are strong indications that some new flight will have to replace the successive-spectacular explanation if Congress is to refrain from forcing more money on the Administration for space work (see p. 31).

Dr. Frank P. Phillips, who is a member of the President's Science Advisory Committee and a California Institute of Technology geophysicist, told a group of newspaper editors here last week that "unless our next flight is 'out field where we have got to do our best'" to end Russia's lead. He and Rep. Virgil Goode's orbital flight may have had little scientific significance, "but we can't write the flag off by saying it wasn't science." Dr. Phillips also said "a certain effect is to be believed" in large rocket boosters. In the past, Science Advisory Committee has been the strongest of those who argued science in the spectacles and those who were lukewarm on untested space flight.

B-47 Postponement

Joint Chiefs of Staff decided last week to postpone a massive postponement in the phasing out of USAF B-47 medium bomber wings because of the unreliable circular error probability of operational Atlas missiles launched in far and the poor record of Polaris missile launches from submerged submarines. At the time the decision was made, the Polaris record was 10 successes in 18 shots. Its last live work, two B-47 had been made on the missile and the record had changed to 12 successes in 20 flights. B-47 planescans from 28 to 15 wings by the end of June will not be killed, but the planescans will be suspended if the ICS recommendation is accepted.

ICS has completed a staff study that would permit it to review proposed weapons systems from a research and engineering standpoint before they go to the Defense research and engineering office. This probably is a result of recent evidence that the Joint Chiefs were not being consulted by their civilian superiors. Review power would not require a permanent increase in the size of the Joint Staff. It stands at 900, short one-third its wartime.

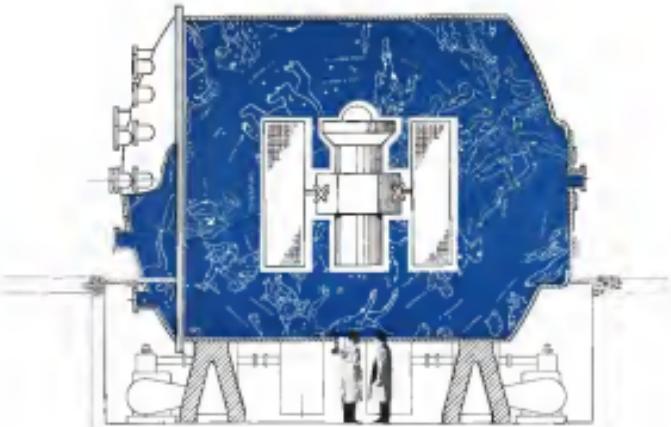
President Kennedy has asked the Budget Bureau to write travel regulations so they give U. S. flag carriers preference for all government-financed travel. State and Defense Department should require civilian employees to travel U. S. lines. Sen. Wayne Morse's estimate is that the government wastes \$100 million in travel annually.

Regulatory Control

The President will soon send to Congress recommendations for curtailing many special functions of federal regulatory agencies. He already has asked Congress to strengthen the role of agency chairman as a step toward tighter control of agency functions. Specifically, he wants more authority for chairman to staff agencies subject to Civil Service requirements from organizational structure, review budget estimates and allocate funds within each agency according to the agency's rating and performance. The President has emphasized that the chairman should be directly responsible to him.

Rep. Stephen B. Dryerhouse has introduced a bill that could kill development of a supersonic transport. The New York Republican represents a district near La Guardia and Idlewild airports and is a strong critic of aircraft noise. His bill would require Federal Aviation Agency to jettison use of any aircraft in commercial service that could exceed speeds of current aircraft. Rep. Dryerhouse said he wrote the bill after FAA Administrator Noyes Huldy told Congress for \$14 million for supersonic transport development. The money should be spent to solve existing airline safety problems before "creating other problems," Rep. Dryerhouse said.

—Washington Staff



SATELLITE IN DRESS REHEARSAL. This 20 x 27 foot, high vacuum chamber now under construction is the newest addition to our series of chambers for complete space system development, assembly, and test at a single location. Full-size spacecraft will operate in this chamber as in orbit. Satellites will be subjected to both simulated solar glare and the chill of space darkness. They will also experience launch and boost conditions, and structural and thermal loads. Career opportunities are open to better engineers and scientists to staff this expanding space laboratory.

BENDIX SYSTEMS DIVISION
ANN ARBOR, MICHIGAN



Industry Shapes Supersonic Design Goals

IATA conference concludes supersonic airliners are technically feasible but economically undefined.

By David A. Anderson

Moscow, Que.—Broad specifications for supersonic transports, now generally accepted as inevitable by the early 1970s, began to take shape here last week at the 14th Technical Conference of the International Air Transport Association.

Such transports will be about the geometric size of today's jets but will weigh approximately 400,000 lb. They will seat about 150 passengers, probably in all-cabin configuration, carry more than one stage length (initially of 3,900 seat-in-ft), with growth to twice length later built into the design. Cruise speeds will be on the order of Mach 3 and altitudes will approximate 75,000 ft. In holding patterns, approach and landing, overall performance will equal or better today's transports.

The first official exposure of open slots in designs by helped manufacturers to narrow gaps between groups and to give birth new apprehensions of each other's problems.

For old hands at the game of designing transports to match the requirements of the world's airlines, this meeting provided new detailed factors that had to be fed into their project teams.

For relative newcomers to the field of aerospace transportation, that meeting provided a series of factual inputs that gave more solid information than dreams of trips into the unknown.

One conclusion of the Technical Conference was that supersonic transports are technically feasible, but economically undefined.

"We don't see how to build them," said one engineer. "But we haven't the faintest idea about just how costly."

Costs Not Defined

For airlines, that all-important parameter of economic cost factors did not develop thoroughly. Also the first approach was a general agreement among old-line suppliers of the world's transports that costs would be comparable to today's values. But several engineers, and at one particular no-think in terms of supersonic costs and that conference should consider exploring costs per route.

Actually this conference used no definition to technical terms broad enough for supersonic transports. Broad concepts, built in a configuration and operation sense, began to show through the front of detailed questions and answers that sometimes seemed to obscure the general picture, but what it boiled down to was this: Airliner operators—with very few exceptions—wanted a profitable supersonic short-haul and capacity of today's subsonic jets, especially

variable geometry or boundary layer control that would give them Mach 3 without the capabilities of a Douglas DC-8 in cruise.

Technically it looks like a long way from the configuration studies of NASA, which datum variable morphed, to some of the final geometries of some firms. "Work 100 days, expect to [lose] 100," said one designer. "I wish we had to design a complete airplane instead of just getting the best idea in the world for aerodynamic configuration."

Mr. Stark himself is the first to point out that there is no technical manager in NASA's studies showing variable sweep, or any method of fixing low-speed problems. He and North American Aviation is working in the right direction by using drooping wingtips. This gives additional directional stability at supersonic speeds while avoided increased impact risk at landing speeds.

Most manufacturers agreed that variable geometry of some sort will be necessary, but there was much to emphasize that variable geometry did not necessarily mean variable sweep. "We're not variable geometry for you," said a program manager, "and the first work pretty well. We're thinking now of canted wings, for example, and turned horizontal tails."

Most designers felt variable sweep was not the best choice and suggested the use of mobile surfaces for fuel that would be the result of accommodations of the aircraft not inboard on a variable sweep wing. But some of them would categorically rule out any geometric changes in the airplane now for any reason, fearing to wait until the project had considerably more study time behind it.

But although they agreed on variable geometry and the provision of good low-speed performance, there were as many disagreements about the way to design the airplane as there were designers.

Supersonic Projects

Current inventory of supersonic transport projects shows a total of eight, including five from the U.S., one from Great Britain and one from France. In the U.S., old-line transport companies such as Boeing, Convair, Douglas and Lockheed had been joined by rough newcomer North American Aviation. In England, British Aircraft Corp. is combining its talents with British Aerospace. In France, the Sud Aviation and Dassault is a dark horse in the race, drawing strong support from the capacity of today's subsonic jets, especially

airlines of Dassault, the size and accumulated talents in Sud Aviation plus the continuing expansion of Air France with flight tests of a stretched transonic powerplant in a Mach 2 Concorde aircraft.

None of these firms is undeterred by the competition. "Remember, we never took the Concorde seriously until it was too late," said one American airline captain. "The French could have someavigous success again."

But whether the supersonic transport of the 1970s bears in Amsterdam, British at French marketplace, will have to wait until further meetings in airline terms of the world. Ultimately there is no solution for paying the price of a supersonic jet, said a spokesman for the aerospace group, who is with IATA. In agreeing this morning, and that, he said, is the price of the ticket.

First Centaur Flight Delayed Six Months

Washington—First Centaur launch date has been delayed six months to November because of a faulty separation system, which caused three test shell explosions at the Pratt & Whitney Florida facility, Mt. Can Dan R. O'Connor said. The House space committee has been told.

Gen. O'Connor, director of National Aeronautics and Space Administration launch vehicle programs and manager of safety, finance and logistics of the LR-103 liquid oxygen/liquid hydrogen engine has been necessary because the original system incurred an improper mixture which produced "a half of an engine" around the nozzle, he reported.

NASA has shifted to liquid/hydrogen/oxygen engine engine program to emphasize the 15,000-lb-thrust configuration for Centaur and Saturn. Last week, the agency's contract with Pratt & Whitney for the development of the LR-103 engine had not been canceled (AW April 17, p. 19). The original engine, which could not be tested, cost \$7.5 million. In place, however, is a present replacement, which it was replaced by the RL-1015 in Saturn G-1 and C-2 engine stages.

The Research Budget added \$25.6 million to accelerate development of the Centaur vehicle (see photo p. 90), most of which now will go to the LR-103 engine. NASA's other hydrogen/oxygen engine, the RL-100100, developed by Rocketdyne, Inc., remained an additional \$5.6 million in the new budget. Closure of the LR-103 engine will power the second stage of the Saturn C-2.

Pratt & Whitney plans to exercise product improvement as an uprated hydrogen/oxygen engine to increase both thrust and specific impulse of the LR-103.

U.S. Offers Canadian Production Of F-104s for Greece, Turkey

Washington—Negotiations for production of about 380 Lockheed F-104s in Canada to replace an agreement between President Kennedy and Canadian Prime Minister John G. Diefenbaker, will enter another round later this week in Ottawa.

If they go into production, the 380 fighters will be given to Greece and Italy under the Mutual Security Program. They will be added as an addition to the CF-104s in Canada's building for its own use.

The plan at a major concession to Canadian negotiators that the U.S. has not paid enough attention to the official policy of an early exchange is weapon procurement between the two countries. Dif's problem seems to be in deciding which companies would build engines, electronics equipment and surface subsystems. Production defines in both the U.S. and Canadian defense industries have created political pressure which is making negotiations difficult.

Canada, which bid last at U.S. 10 aircraft to the Canadian CF-104 program, will not take little part in future aircraft production when the U.S. is given the bid. G-135 and G-136 for its interior safety needs. Gemini is the only major surface manufacturer remaining active in Canada since Avro Canada, Ltd., was recently reduced to control problems of the CF-105 interceptor.

Lockheed has a sizable F-104 production program of its own and has subcontractor contracts for the C-130 and C-141 cargo transports and the Polaris missile. The world will notice the impact of losing further production in Canada. Canadian aircraft which have been affected by the Canadian, Diefenbaker, and which could not be tested, cost \$7.5 million. In place, however, is a present replacement, which it was replaced by the RL-1015 in Saturn G-1 and C-2 engine stages.

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The RL-103 engine will be the F-104's powerplant, and blade frequencies will be increased. C-11. Dif's program for avionics in the Requirements Division of Air Force design chief of staff, Major General Frank D. Wolf, who was standing on the helipad just off the C-112 passengers and crew were not injured.

Greece's offer also, with the F-104 and the MDAP F-104 regarding a competing gauntlet, the CF-104 in optical flight.

In addition to the CL-44 and the CF-104, the Canadians feel that other designs of theirs have been overlooked. Another aircraft mentioned is the Avro armament research aircraft. They point out that this has been partially developed, with the U.S. last month, including the DC-8 for Trans-Canada Airlines, and they feel the aircraft crosses the line here one was.

F-104 production is other than MDAP, production, called Mutual Security Military Sales, is expected to reach 1,900 in European production, rising almost 52 billion in 1965.

West Germany is producing the complete F-104G, using components made in Europe, augmented by some parts from the U.S. In the German Air Force, Dornier and Canadair (GDC) represented as GDC are West Germany, The Netherlands, Belgium and Italy.

The decision to produce MDAP aircraft in Canada will have an impact on the European GDC operation, which had hoped for the business.

F-105 Close Support Demonstrated by USAF

Tactical close support capabilities of the Republic F-105 fighter-bomber were put on trial last week at top officers of the Army and Air Force watchdog panel meetings in the area near Nellis AFB, Las Vegas, Nev.

The demonstration was the result of recent addition of the close support mission to the F-105's mission, including the F-105 and the North American F-100, claiming they could not operate from unprepared airfields, are not fitted for delivery of conventional weapons and are too unaffectionate and expensive.

Major Gops and the Navy plan to match the Air Force show with a similar demonstration April 25 in the area of the Cherry Point N.C., Marine Corps Air Station.

A Vertol B-21 helicopter crashed just after takeoff during the Nellis AFB demonstration and blade fragments killed Col. Wissell E. Downing, assistant for aviation in the Requirements Division of Air Force design chief of staff, Major General Frank D. Wolf, who were standing on the helipad just off the C-112 passengers and crew were not injured.

Douglas Cites Recovery Prospects; Stockholders Critical of Report

Los Angeles—After two three-year, Douglas Aircraft Co. is headed toward recovery, says Donald W. Douglas, Inc. It had 1,700 stockholders at the annual meeting here, but there was almost three times as many individual stockholders.

The company reported a profit for the second consecutive quarter, but its end-of-quarter results are to be paid because of extensive provisions in Douglas' long-term debt structure. A stockholder rise to us that according to his interpretation of the annual report, no dividend could be possible for you or three years.

Douglas Douglas, Jr., president of the company, and many factors could affect the date or amount a dividend will be paid.

For the first quarter of fiscal 1961, which ended Feb. 28, the margins, it reported a net profit of \$31,713,000.

Sales were \$204,866,000 compared with \$271,919,000 for the first quarter of 1960. Profit as the 1,016,000 shares presently outstanding was 45 cents each, or a gain of \$1.80 a year earlier.

Total backlog at the end of the quarter was \$379,707,000, of which \$646,315,000 or 75% was government work and \$331,369,000 or 25% was commercial. Bidding a year ago was \$51,413,463,000, with \$746,245,000 as 52.8% government work and \$507,110,000 or 47.2% commercial.

The new directors, Charles R. Able and Andrew R. McCormick, were elected. Able is vice president—defense programs and McCormick is vice president—commercial programs.

Corrective Measures

Douglas cited not cutting and diversification measures that the company is taking to improve its position. He said that about 1,200 employees have been transferred from the company's Santa Monica Division to the Long Beach plant as a move to centralize all transport activities there. Missile and Space Systems engineering personnel are being centralized at the company's Costa Mesa facility. Assembly production will be returned at the Santa Monica facility.

Douglas and the company are attempting to cut areas of the Long Beach plant which will belong to AFAC (Air Force and Space) and sell other areas which are no longer needed. Air Force is reported to be interested in bidding over the problem areas and insulates facilities at Lathrop, Calif., in make room for expansion of USAF's Air Force Space Agency housing the Ballistic Missile Systems Division

and the Space Systems Division which, before recent reorganization of the structure, had 2,200, 275, were both part of the Ballistic Missile Systems.

While the transition from a great deal of long-run production work to an emphasis on short-term profitable research and development makes it difficult to estimate cashflow rates, it is believed Douglas' overall bidding rates are among the lowest in the aerospace industry.

Douglas stockholders closed the door

on him and he had heard that Douglas will the \$30,382 net retention compensation because its net worth is \$1 million above the last dividend paid.

Another said that in 1951, Douglas' sales were only a quarter of last year's sales but the company was able to show a \$5 million profit. He called for a reduction in cost.

Chairman Douglas replied that there was not much a wide disparity between the Douglas and Lockheed price for B-58 and predicted that Lockheed would "find considerable money" on it if USAF fails to bid enough design orders to let the company capture the contract.

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NAA Aid Requested

Washington—Congress has been asked to authorize a \$440,000 appropriation to the Secretary of Defense to help the National Acoustic Area, finance world-wide seismic measurements and a General Conference of Fisheries and Acoustics.

The congressional conference would be held in conjunction with the 1962 World Congress of Flight at Las Vegas, Nev., Sept. 16-23. NAA will handle the ground-truth portion of the conference regardless of whether the full panel, but a spokesman and NAA assistant play host to the share plenary and conference without aid.

The bill was introduced by Rep. Otto Frueh (D-Tenn.) at the request of Jameson Cochran, former president of NAA. It has been referred to the House Armed Services Committee for action, and Rep. Jameson has asked Defense Department for its comments. The bill would provide that the secretary funds instruments for the plenipotentiary, the committee, and other purposes.

Plenipotentiary events would include: global monitoring, model aircraft flights, geotethering, and helioseismology.

Reduced 1962 Cessna Earnings Forecast

Cessna Aircraft Co. sales and earnings will not meet last year's level, President Donald Douglas, Jr., and others will be over 10% off at Douglas, south of the Long Beach plant, but that improvement will soon level off. He and the trend cannot start again, and sales will drop about 10% in 1963 if no new or more new contracts develop, he would have two or three more in the first year," he said. President Douglas pointed out that Long Beach is the only facility in the country in which both the plant and the airfield could handle a supersonic transport.

He said that the company has been disappointed by slow sales for the DC-8 and the 360 Comanche but has hopes for an upturn in the future.

Commenting on changes in the last year, Douglas said that engineers have been from 50% to the company population to 25% in the past few years and that the programmatic profile has been reduced.

The company has not yet started

the company's part of its reorganization.

The stockholder vote will be held on May 22, 1962, and the company's part of its reorganization will be completed.

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AIRPORT WEEK, April 24, 1962

Explorer X Maps Solar Magnetic Lines

Washington—Explorer X has provided "intrinsically clean" data on earth and interplanetary magnetic fields which support the theory that solar winds are strong and relatively stable at distances at least as far as 145,000 m from the earth, the limit of the satellite's measurements.

From preliminary findings presented about an hour ago, data provided by the magnetometer package, the National Aeronautics and Space Administration has mapped solar magnetic lines which are nearly stable away from the sun and are composed of streams of particles which converge at low velocity. For the earth's magnetic field at distances ranging from 32,000 to 100,000 m above the earth's surface.

The satellite, which was orbiting at a specific altitude during its 63 hr of operating time, is still in an orbit with a 100-mi perigee and 145,000-m apogee.

Significant preliminary measurements made over portions of the trajectory include:

- First sampling of the density and intensity of solar protons. In the relatively stable state, it was found that solar winds containing 10 particles per cubic centimeter moved at a velocity of about 160,000 mph. Velocities increased to 152,000 mph after a solar flare which occurred Mar. 26.

- First confirmation of the exact timing of a "hidden commencement" of the semi-diurnal propagation of particles on the earth. About two minutes after the beginning of the solar flare, a wave traveled across the surface which was approximately 146,000 m farther from the sun. Shock wave was observed 25 hr, 26 min after the flare was seen, coupling on the sun.

- Violent variation of the interplanetary magnetic field was recorded in the satellite's vicinity about four hours before the Mar. 26 solar flare, but additional study must be made to relate and possibly predict solar storms as the basis of interplanetary plasma distributions. Current strength during the flare varied from 5 to 40.

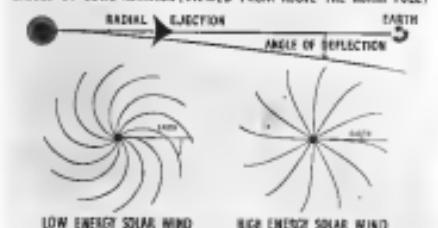
Explorer X measurements passed several records during most of the flight. The suborbital vapor望远镜 was stopped operating at an altitude of 68,000 m because of because the heat after its cutting was concentrated by rocket exhaust.

SOLAR MAGNETIC FIELD



Detailed analysis of Explorer X data is reported to provide a map of the solar magnetic lines of force. Preliminary findings using about 19% of available data indicate a high-energy, relatively stable wind control lines in the sun's line of force nearly parallel

THEORETICAL BENDING OF SOLAR WIND MAGNETIC FIELD LINES CAUSED BY SUN'S ROTATION (VIEWED FROM ABOVE THE NORTH POLE)



Air Sampling Project Reveals Sulfur Layer

Washington—Three-and-a-half months ago the earth's north, 45% of it with particles, has been discovered as a series of balloons and aircraft flights in an air sampling project being conducted by the Air Force Cambridge Research Laboratories.

The layer, which begins at an altitude of 13 mi, is thought to scatter sunlight and cause the air to glow at sunset and sunrise. USAF's Office of Aerospace Research began the project last year and has found uniform sulfur layer densities between 11-14 nm in flights ranging from Texas to Alaska to Australia.

In another air sampling project, the National Aeronautics and Space Administration and the United States Geodetic Survey has begun upper-atmosphere Nitel-3 flights of aluminum thermocouple clouds (AWP 16, p. 31) to determine geographic variations in high-altitude wind velocity. Series of three flights were planned from Wallops Island, Va., and Siberia.



First Photo of NASA-Convair Centaur Vehicle

First photo of a complete Convair Centaur upper stage, which will be used with the Convair Atlas D rocket, is shown. The stage is mounted on a large industrial facility. The stage is shown with its nose cone removed, revealing the internal structure. The stage is mounted on a large, circular platform, and various equipment and cables are visible around it.

Army Needs Faster Reconnaissance Data

Washington—Army has growing need for instant transmission of battlefield information to troops from 10 to 40 ground controllers. At the moment, the Army is employing slow reconnaissance methods.

No longer can a decision wait the return of an aircraft and the processing of film, end-users panel members told the Institute of Aerospace Sciences' National Arms Aviation Meeting. In an immediate battle area, which can extend as far as 300 mi., intelligence data must be available quickly if enemy units are found.

With the addition of its own aircraft, such as the Convair AD-1 Makrak, the Army hopes to fit a unit within its organization to receive and process incoming data for target indications from agents, teams with the surface-to-surface Pershing missile, which would be armed at command posts and mobile targets.

When such information is received, it must be simple and easy to interpret. Human factors must be taken into account with the understanding that semi-trained personnel must be used for photographic interpretation. Methods for training these people were studied by Boeing Aircraft Co. which evaluated 10 methods of teaching recognition of enemy items and of changes in personnel data.

New design designs, more accurate recognition and better sensors and codes will prove more necessary for aircraft of the future, the panelists said. Commanders' arms, other than needs for the period 1970-80, congressional were made between naval, air and ground. A continuing need for the

reconnaissance aircraft was found, because this type is more economical for combat than a ground unit.

The helicopter is limited to about 100 ft above speed because of the risk of retreating blades.

The compound helicopter, however, which would have wings and would land the rotor and pitch on slow, it would be faster, show a promise for speeds of 239.41 mph with turboprops and 307.41 mph.

For short, heavy body helicopters will probably use the hot rotor system, which does not add to the rotor mass. The cold rotor starting system, when heated in the cockpit, is more efficient and can be used for longer range flights. The wind-driven helicopter will receive the favored configuration. The hot rotor also would be used for the compound aircraft.

For having weapons, the helicopter is expected to remain the most efficient vehicle. Effects, however, as the different effects, mission with vehicles using laser and ground directed energy.

It was predicted that the big difference in using wing aircraft will be the compound configuration, but that advances also will be made in other areas.

During future conflict for aircraft, this and the Army will have to pack up the half an airfield capacity. In-space forces for nuclear weapons are expected to have fuel consumption down to 0.3 to 0.7 lb/lb/ft and weight down to 5 lb per pound of Roger weight.

Early aircraft control and by stick control, as in an aircraft. Test subjects are now being developed, including the stick control, while more flight options are being tested on the two aircraft.

Controlled effect machines which use the air cushion principle to expand ion energy for returning aircraft have been studied to incorporate aircraft shapes in order to achieve greater forward speeds. Instead of the current 151.41 mph, 200 mph is considered possible with this system.

For the 1970-80 period, priorities on current land wing aircraft for the Army would be: 1) a fast transport, which can be used for personnel, 2) a transport aircraft of moderate weight, carrying heavy loads.

Short range and landing performance would be enhanced by use of boundary layer control, probably by blowing air over the flap tips to return airflow or flow at high angle of attack. Other systems employing systems involve controllable, slanting and use of the aircraft.

For having weapons, the helicopter is expected to remain the most efficient vehicle. Effects, however, as the different effects, mission with vehicles using laser and ground directed energy.

During future conflict for aircraft, this and the Army will have to pack up the half an airfield capacity. In-space forces for nuclear weapons are expected to have fuel consumption down to 0.3 to 0.7 lb/lb/ft and weight down to 5 lb per pound of Roger weight.

First Orbital Mercury Shot Set This Week

By Edward H. Kolens

Washington—United States plans to orbit an unpiloted Mercury capsule this week, while Congress is virtually offering a black check to accelerate the civilian space-space program so a later launching of the first orbital capsule would be feasible.

The House Committee on Science and Astronautics, swayed by the orbital flight of Soviet cosmonauts Yuri A. Gagarin, urged the National Aeronautics and Space Administration to "act as you need . . . and we will help you get it."

Dr. Robert C. Seamans Jr., associate NASA administrator, responded to searching committee questioning by estimating that in an all-out effort the U.S. could send a man to the moon in six years instead of the 9-10 yrs. in the present plan, but the cost would be as high as \$40 billion—\$8810 billion more than with the longer schedule.

The orbital Mercury shot, under consideration for June 14, is an attempt to gain the orbital range of the third Attached Mission, now (MA-3) and MA-4, though several experiments are planned. The capsule will be designed to test reentry and ground communication and command frequencies, check out ground tracking stations and, on reentry about 10 minutes after it reenters, place one orbital.

The original proposal differs from the current. The original budget by \$102.5 million, altering these plans in addition to Apollo. • Rover nuclear rocket engine program: \$15 million deleted for feasibility to test the complete Rover engine, and \$8.3 million deleted from research and development funds. Each of facilities will share the program \$9 million. It also will be the first Mercury capsule to go on a satellite mission.

MA-3 originally was planned to reach other planets and orbitals, then to an interplanetary mission about 3,000 mi. down range, consisting of about 100 days of flight and insertion.

NASA and the Air Force know a space module MA-3 with the same test objectives can expand the development schedule of the Mercury program. First reentry ballistic flight, which follows a successful MA-1 without a success. A Little far right from Wallops Island, will be scheduled for Aug. 22 at the third attempt to test the production capsule and use the interim model reentry dynamic bench.

At the hearing, Minuteman Research Corp. presented a new "golden" plan for the program, which the committee believed could have a much more rapid orbital flight under a schedule which could beat the 1974-Saturn C-3 orbital flight date. It will be built in a solid with a specific impulse of 350 sec., but it is based in a liquid motor and gelling agent to form a solid cluster. The capsule will be the one to be delivered to the launch vehicle for 86 cents per pound.

In the NASA testimony, Dr. Seamans

said Apollo was cut from an original \$71.2 million to \$79.5 by both Kennedy and Eisenhower Administrations. Dr. Seamus through recommended reduction of \$47.4 million for Apollo, which would result instead of a hard-landing capsule, a smaller, more direct orbital flight with intermediate spaceplane model. He estimated the flight program could be accelerated 6-12 months with full funding.

First part of the Apollo flight program, delayed from the budget, was re-structure of the last test. Project Mercury production capsules for mid flight, early orbit, containing primate passengers. That would be capsule 21-24 produced by McDonnell Aircraft Corp.

Congressional committees also showed that the agency requested fiscal 1962 funds totaling \$1.4 billion, of which the President's Administration approved \$1.1 billion. Kennedy Administration funds added \$12.7 million to the Eisenhower budget.

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NASA's management philosophy since early 1960s, particularly from Rep. James Fulton (R-Pa.), who accused the agency of succumbing to the Budget Bureau without an argument. He suggested that the management team of Rep. Adlai Stevenson and Vice Adm. Hyman Rickover, head of the Navy's nuclear reactor program, be transferred to the space agency.

USAF, Army Detail Aircraft Plans

Washington—Air Force and Army disclosed additional details last week on aircraft and missiles planned for purchase during fiscal 1962.

Air Force in Congress that it has requested \$71.2 million for aircraft procurement and \$530.8 million for missile procurement including:

• Bell Boeing helicopter \$67.6 mil. for 24.

• Vertol Chinook transport helicopter \$15.4 million for 21.

• Republic F-105 fighter \$169.9 million for 192.

• Northrop T-38 pilot trainer \$828.9 million for 144.

• North American T-38, specialized aircraft \$15.5 million for 11.

• Lockheed T-38D support aircraft \$1.7 million for 10.

In addition, \$10.2 million is allocated for spare parts, surveillance, logistics and transportation to initial delivery.

The seven variants in Army's fiscal 1962 procurement program are: Hawk, low altitude defense missile, Nike Hercules, surface-to-surface missile, \$157 million.

• Boeing B-57B cruise missile, \$10.7 million.

• Rockwell QRC cruise for weapon testing, \$10.9 million.



First Photos of GE's Apollo Configuration

First photo of General Electric Manned and Space Vehicle Department's concept of the *Beverton* Project Apollo space vehicle shown midflight in congressional hearings. Dome-shaped capsule module is Navy and道格拉斯 re-entry module in one version of the command module, which would house four in flight and return three to earth. Beneath the central section of the complete vehicle is another section of the command module. Rocket on front skirt is for emergency escape during lower phase. GE is one of three companies working on Apollo feasibility studies for National Aeronautics and Space Administration.

Soviets Will Explore Space Survival Limits

Moreover—Near range goals of Russian space research will include, demonstrating the extreme limits of survival of living organisms in order to make prolonged flights to planets as safe as earth orbital flights. Similar research reported, but work

Medved scented 65kg Garinka by heart, on the basis of Mr. Yury Gavrilov's flight around the earth (p. 12 (AV Apr. 17 p. 26) that it will not be necessary to train man to endure weightlessness in flight to accomplish these flights.

Prof. Ireni Manoli, director of the Academy of Medical Sciences' Experimental Biology Institute, said the work has now come to make more detailed studies of the effects of space factors on biological substances. Especially important, he said, is the study of the tissue basis of survival of living cells, but effects of prolonged weightlessness on bone marrow processes also require more study.

levitate that the walls of Space space design ensure sufficient radiation protection at the altitudes now under consideration", but said with positive vision into new realms where radiation is "more intense and has greater penetrability". He said protective measures will need further protecting.

English-Indian director of the Academic Institute of Reptiles, Primate-ecological Biology, and zoology of poecilioplatyids with living organisms have proven encouraging and have shown the range of possible egg sets, which can affect to be small doses. Let below

the threshold at which reflexive consciousness could be expected. André Libchaber, a member of the Académie des Sciences, told the *Le Monde* news agency: 'This is the most carefully considered acceleration-weighting system and subtler to be the three previous designs in that order before Dr. Gagnon's flight.' A recent article in *Medical and Biological Engineering* referred to a '7 g or 8 g acceleration as the maximum limit for launching a spaceflight'. Prof. Vladimir V. Dolgov, mentioned that Gagnon's flight resulted in a maximum acceleration of 6 g.

Pilot Error Ruled Out In Downing of B-52

As Iran has decided the number of which is now 400 Artillery and Guard 1-100 aircrafts that down in Shargh Air Command 8-17 January with a Sukhoi-24 aircraft, 300 crew

is an unknown mechanical softness but rather than be pilot error.

Major Gen. Paul B. Griffith, departmental inspector general for safety, said that positive steps have been taken to prevent recurrence of this type of accident. "Most alarming cause of accident was releases from modern jet fighters of stores such as fuel tanks, bombs and napalm are manifestations of a mechanical failure," he said. "Other causes include electrical trouble, circuit breaker failure, fire, means to banish oxygen, gear failure due to moisture, fuel leakage, foreign objects, faulty construction and human lending error. Pilot error is a minor cause of accidents."

Space Pressure Suit Designed by Latex

Washington-Diversified—Latex Corp. has developed a full program designed to meet requirements for both encounter and wear surface operations and to permit a customer to upgrade himself, for example, in the speed of vibration.

The TH-10 suit is the first garment developed specifically for protection against radiation temperature and pressure hazards of space according to Lennard F. Shepard, research and development manager, Latex Convoluted and Industrial Products Division.

Later developed the suit, as a program which started 16 years ago under joint Air Force Systems Command congressional funding. Cost of the program to date is estimated at \$500,000, equally shared by USAF and AFSC.

Self-contained environmental systems for specimen storage outside the spacelab is named as a battery operated back pack. The company has worked with the Garrett Corp. to develop a system which will use the energy of evaporating liquid oxygen to power the portable environmental pack. Latex also is developing light flight boots with magnesium attachments to replace the fibreglass standard boots which now are part of the system.

The unit could incorporate self-contained radiation shielding to prevent water or saturated air from passing through a liner in the outer liner. Shipping and pumping systems would be activated during passage through the Van Allen radiation belt and during a solar storm.

The test can be done in a polarized beam in 4-nm steps. It has been done through a series of temperature profiles reaching 260°F (127°C) for 35 minutes. Cooling is provided through an air-cooled plate heat exchanger and circulation system which removes carbon dioxide and provides continuous control. Sheet temperature can be varied between 100°F and 250°F.

Because of its mobility and ease of mounting, Shagard said, the unit is an operational piece of equipment rather than an emergency device such as other anti-aircraft spikes which prevent and reduce the threat a "pursuer" or killer has. He said its potential use in various policy, operational, flight and exploration of the moon's surface requirements for these missions have been defined.

Art. consists of pressure retaining and venting system made from made of nylon cloth which has a com lined neoprene liner at each joint. The valve mechanism is a poppet type valve with a bias spring. It is connected to the soft with a triflange ring seal and corrugated neoprene neck section.



ANAL PRESSURE gages are developed by International Latex Corp. provide mobility by use of segmented pressure gages in the inner valve shell. Outer layer, also of polyvinyl, has an aluminum vapor deposit. Retractable lead pack holds a portable electronic system designed to provide a means to operate in space outside the craft. If they are saturated hydrazine can be pumped into the unit to provide additional protection. The 13.8-in. and 20-in. gages, and end caps, are designed by a subcommittee of the



Bell Attempting to Consolidate Unions

By William H. Gregory

Bell Aerospace Co. is attempting to reduce the effects of a number of unions it deals with at its Buffalo, N.Y., facilities from one to three as part of a program begun last October. The acquired Bell defense companies have mostly one.

The Textron formula for its business-complex type of arrangement of Bell does not include anything radically new to the defense business, but it has produced some specific short- and long-range goals right out of the personnel council being set.

Bell Aerospace area employment has gradually declined from 18,000 peak in 1966. Further personnel cuts will be based on Textron's proposal and the unit will proceed but no more in Bell's B-52 engine nozzle subassembly contract, which was not preferable, phased out. From a low point of less than 1,000, employment has since risen to about 3,200.

Drop in business appeared to be a factor in gaining union acceptance for some consolidation. One union group has agreed and a decision is expected by June 1 from the regional National Labor Relations Board, which conducted hearings in the case last month.

The request by Bell to consolidate the unions is a two-edged sword, one the legal problem to guide the Board. The other is the union's proposal of affiliation with the American Auto Workers (UAW) affiliate, UAW.

• **Local 918** composed of production workers, now with about 900 members.

• **Local 1396** composed of four separate groups of workers held left production engineering, extracting, and production control. Each group has its own free-giving representatives and their own contract and its own officers. Total membership has been about 1,000.

• **Local 516**, also composed of four separate groups with individual officers and bargaining and shop committees, represents management, accountants and fire control.

No change was sought at Local 181. Local 116 agreed to consolidate to the consolidation into one group two months ago, and 12 days bargaining committee. Bell Aerospace dealt with management was reduced to six people and the number of shop committees also was reduced. The other local, 1298, decided not to accept the proposal and thus the bickering. In bargaining committee of 25 people also would be reduced to six.

The positive role of the Textron-Bell program, as described in *Aerospace Week* by George W. Miller, Textron president, is for Bell to establish itself in proprietary design fields to avoid be-

coming what he described as a glorified job shop.

To this end, Bell is pursuing what would seem to be a contradictory course of seeking major subcontract work on the Lockheed C-141 military cargo transport. The theory is that Bell could use such business to gain time for proprietary development and to refresh its workload in its Buffalo facilities to make its proposals in Bell-designed products more competitive in American market proposals made jointly with Lockheed, for example.

Bell eliminated Bell's long-range engine, a 100,000-lb thrust bypass after the engine's first flight, but the afterburner section where Bell's expertise and capabilities, can be competitive in cost and where it successfully could make a contribution to the national effort. Miller listed these areas as important for Bell's Aerospace Rocketdyne Group, one at a time into which the Buffalo operation is divided.

• **Rocket propulsion** for upper stage and space ships. This is based on Bell's J-201 engine now in four-month production for the Defense, Manned and Space programs, and would call for development of a family of engines. Bell is in this market, and would use the big liquid field, but might possibly turn to electrical propulsion on a company-sponsored basis if necessary.

• **VTOF aircraft**, based on Bell's background with the X-14 reflected thrust experimental aircraft and its ongoing jet experimental work.

• **Reaction controls** for space craft.

• **Structures** for special applications, such as Bell's glass wall structures developed for the Dynetics proposal.

• **Target drones**, based on a license with former North American U.S. Navy now evaluating a North vapor-space drone, the CV-1.

• **Other areas**, the Bell Aerospace group is involved, and it is unusual.

• **Automatic Landing Systems** now under contract for installation on some of the Navy's aircraft carriers.

• **Aeronautical and velocity measuring devices**, one new, used in the Space Shuttle and other models. These are developed at Bell's Aviation Division Instrument Laboratory in Cleveland.

• **Incident prevention systems**.

Trotton's role has been to clarify Bell's objectives other than those that now exist, such as has been the case in establishment of the Textron-Bell management relationship.

Harry Gaylord, brought from the presidency of Bell's Aerospace Division in Ft. Worth, Tex., to become president of Bell Aerospace Corp., was given a letter and charter assignment,

Miller said. Corporate officers offer that Gaylord was eliminated, and he reports directly to Miller at Textron. The presidents of each Bell division, Aerocarriers at Buffalo, Helicopters, and Helitug, the Bell-McCormick Co., Research, Calif., report directly to Gaylord.

Trotton, which acquired Bell as part

of a previously divested and

expansion program (AW Apr 25 1968 p. 31), believes primarily in operating with a small Textron corporate staff and giving the various executives latitude to pursue.

Planning for the other two divisions

has been more of a long-term nature

since they had fewer immediate problems than the Buffalo division. Two major turning points will soon face the Helicopter division, however:

• **Decision on certification** of the Model 280, a commercial version of the Bell HU-1 helicopter. Miller and Trotton likely will be a place for helicopter basic and helicopter redesign at proposed jet fields, and there will also be a place for helicopter innovation—where the 280 fits. Evaluation of this and the potential executive market will help answer the question of whether to certify the day, Miller said.

• **Army decision** on the light observation helicopter (LOH) competition. Any choice that could put a new manufacturer in the light helicopter field would make Bell's position in it very ambiguous, Miller pointed out.

Longer term decisions also face the Helicopter division, Miller added. These range from whether the HU-1 should eventually have its single engine replaced by two small turbine engines to how the VTOF capabilities of the Helicopter and Aerospace division might eventually fit.

Bell has discussed plans for a re-

search center in the Buffalo area based on a research center the Lowercase D Bell, and it has had its part put in for mile. Building of such a center might be undertaken eventually, Miller said, but Washington, Superior California or Florida is likely sites.

Trotton's biggest intent to Bell, Miller said, is in its ability to win. The parent company is committed in an effort to avoid external savings of any sort, and it has the credit and capital to back Bell in any sizable undertaking. Bell has its own line of credit with banks of \$16 million, and Textron can supply additional credit.

Fundamentally, Trotton's goal is to

break the when is with Bell had the

reputation of having "too many firms

and not enough funds," in, to gain

solid profit balances from the design

and analysis of the company.



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Kennedy Reviews Decision to Begin Rover Engine Flight Test Program

By Katherine Johnson

Washington—Kennedy Administration is reconsidering its decision to move forward with a flight test program for the Rover nuclear reactor and is seeking the estimate of an independent panel of consultants appointed by Presidential Science Advisor Dr. Jerome B. Wiesner and headed by Dr. Harvey Brooks, doyen of engineering and applied physics at Harvard University.

Brooks was drafted in a letter last week from A. T. Kadlec, general manager of the Atomic Energy Commission, to the Joint Congressional Atomic Energy Committee. It reached off a position on the House floor by Rep. Melvin Price (D-Ill.), chairman of the research and development subcommittee, that the Administration is losing the opportunity to make a significant gain over Russia in the space field by delaying that project with its potential for interplanetary exploration.

Both House and Senate Administrations, however, in January, had approved a program in the Kennedy Administration's March, were aimed at initiation of flight testing of a Rover powerplant—Project Nerva—now seen as technically feasible.

Rep. Price also disclosed that the Administration has denied AEC and National Aeronautics and Space Administration a total \$29 million as Fiscal 1962 funds for Rover related in flight test—including \$15 million to initiate work on engine test facilities at Nevada's Uluru; these cuts are principally reflected, Price said, in the just-passed \$66.67 budget target for flight test as requested. The Kennedy Administration's budget provides approximately \$4 million for ground test facilities but did not provide for the full program aiming at flight test, pending the conclusion of the current study.

Engine Proposals

Concurrently, last week, as NASA's science selection board was considering contractor proposals for the Nova flight engine, authorization by Army-General American Metal Products Corp., General Electric, Pratt & Whitney, Rocketdyne, Thiokol and Worthington.

The Kennedy budget provided \$10 million for the Nova, with \$1 million allocated to AEC, and \$1.5 million to NASA. This is \$9 million more than the total proposed by the Eisenhower Administration.

Meanwhile, AEC announced a \$19.6-million Fiscal 1962 program of research related to aircraft nuclear propulsion, \$14.2 million of Pratt & Whitney, \$1.5 million at General Electric and \$1.2 million at Oak Ridge National Laboratory. The President's budget provides \$25 million, but \$5.1 million will be shifted out into Fiscal 1963.

GE's exploratory work on aircraft nuclear propulsion will be reduced from approximately \$1,500 to \$1,200. At Pratt & Whitney, it will be reduced from approximately \$1,750 to \$1,400.

The ANP program—reduced from the \$10-million annual level of the past several years—is presently considered a lost cause in Congress.

Genesis will receive \$100 million production from two to three a month in July (AW April 17, p. 21). A Clinton, Iowa, company president, said total deliveries to date are 1,000, and that 100 more will be delivered in July. Total sales are up 22 and there are options for foreign sales. First quarter sales for Grammer were about \$75 million, earnings \$1.5 million.

Dr. Theodore Maiman, who successfully operated the first laser in 1960 (AW July 16, p. 96), has left Hughes Aircraft to join Quantatronic, Inc., Santa Monica, as director of applied physics. Other members of the Atomic Physics Group at Hughes Research Lab, however, are expected to join Quantatronic and other organizations which will inquire staffing of the Hughes group projected to work on a \$400,000 Air Force R&D contract for optical lasers.

Jet fuel tax was recommended last week by President Kennedy. He asked Congress to set its first-ever jet fuel tax. The Administration decided that further study was required before implementing the proposed tax, noting the flight test objectives. The recommended budget request that was actually submitted to Congress, therefore, provided for acceleration of reactor testing but did not provide for the full program aiming at flight test, pending the conclusion of the current study.

Air Force Radio Research Laboratory, using a 120-ft. dish antenna and costing \$1.5 million, to study satellite communications and space propagation phenomena will be built for its use at Massachusetts Institute of Technology's Lincoln Laboratory at Lexington. North American Corporation Division will build the antenna, and H. J. Thompson Fiber Glass Co. will build the protective dome.

Proposed to study flight dynamics of nuclear flight craft on the Sora C-2 has been submitted to Marshall Space Flight Center by Convair-Astronautics, Douglas Aircraft Lockheed Missiles and Space Division, Martin and North American Aviation.

British European Airways is negotiating for three Armstrong Whitworth 699 Argosy turboprop to expand its cargo services. Order puts Argosy sales at 166 planes.

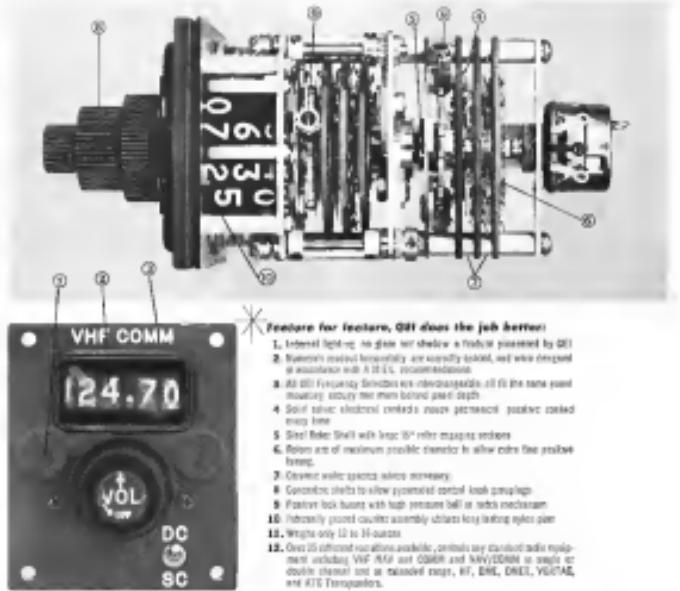
First P-38 Order: Another nuclear warplane aircraft has been accepted by the Navy from Lockheed Aircraft.

National conference on the peaceful uses of space will be held May 26-27 in Tulsa, Okla., sponsored by the National Aeronautics and Space Administration and the Tulsa Chamber of Commerce.

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MUROC TEST RANGE OCTOBER 1, 1947

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Icelandic Pegs Future on Piston Planes

By Glenn Gunina

New York—Although Icelandic Airlines has become an anachronism on the competitive North Atlantic jet routes, the airline expects to continue flying piston planes—and making money—for some time to come.

The Icelandic carrier this summer will be the only transatlantic scheduled passenger airline not operating jets. Nevertheless, it expects to carry 43,000 transatlantic passengers that year in its fleet of three Douglas DC-6B piston aircraft. The airline would experience a 10% increase over last year's traffic on the routes.

Icelandic's weapon against the jets and high-powered advertising campaign of its competitors from The Air Line has never joined International Air Transport Area and considerably reduces even the transoceanic and open all service and extension jet firms of the IATA carriers.

Icelandic Forces

For example, the aviation Icelandic flies in London, round trip, is \$418.60, or \$69.40 under the IATA economy jet fare on the same route. The IATA premium fare is much closer, \$432 in nonstop class. But many transatlantic carriers this season will be offering jet service exclusively on their regular schedules.

Icelandic this year also has instituted 17.4% concession fares for the off season, and a reduced fare basic plan, both moves to match market plan of the IATA carriers, and both well under the IATA jet fare.

Belgrade Airlines' services are popular in comparison with some of the transatlantic giants, but on the other

hand it operates in the black and receives no subsidy, being entirely privately owned by stockholders.

In its fiscal 1948, Icelandic earned gross incomes of something over \$6 million and realized a net profit of about \$100,000. Fiscal 1949 profits were about 75% higher. Traffic increased from 1938 to 1948 was double that percentage, but fare reductions held down the income in revenues.

Icelandic's season load factor last year was over 50%, and average load factor for the year was 65%. Load factor is to be increased to 70% by October 1 to be in effect this fall.

This year's season loads have been increasing, according to the airline, and higher load factor for the year are expected.

Officials of Icelandic say the airline has no intent or leaving jet or even turboprops for the time being. It will buy a fourth DC-6B later this year from Pan American. Most of the other three replaces Icelandic has been on the Atlantic since 1952, operating DC-3s until recently. Last year's fleet was mixed DC-3s and DC-6Bs, but the four DC-6s now have all been sold to various European non-subsidized airlines.

Any future expansion will be gradual—Icelandic doesn't want to grow too fast but has to build its organization on a solid and conservative basis," officials say.

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Icelandic's services are popular in comparison with some of the transatlantic giants, but on the other

hand not operating—including equipment and overhead—is a key to Icelandic's policy. It strives to keep its ground organization small, and charges that its proportion of ground to flight personnel is 65% of that of other airlines. No outside salaries are re-employed, some 90% of its bookings come through travel agents, to which its agents are closely directed. In 1948 Icelandic paid U.S. travel agents almost that \$400,000.

The DC-6B list price is about \$1,000,000 but the airline's cost to buy it is only \$900,000. This year, the airline is running better than 10 to 12% above operating costs, the airline says, up about 20% below the U.S. domestic average. For the same plane—principally because of the low overhead operation.

Route Pattern

The airline also benefits from a favorable route pattern, exclusively long haul, with multiple terminals in Europe (Amsterdam, Copenhagen, Glasgow, Geneva, Hamburg, Helsinki, London, Luxembourg, Oslo, and Stuttgart) in addition to, of course, Reykjavik, its home base in Iceland.

Passenger air Icelandic's plane equipment is a 14-passenger, 10-cabin configuration. Air freight rates are close to the former IATA basic class, thus to encourage and pitch in the first aircraft configuration is 35 cu. ft., providing more leg room than the economy passenger jet. Complete seal and fire doors are armed. A fire truck on the ground is provided at the Reykjavik stopover, which is scheduled at 15 hr.

Of course, the trip takes a relatively long time. Flying time is scheduled at 14 to 15 hr to Europe, depending on



Sabena Operates Caravelle 6

Sabena's first Caravelle 6 twinjet Convair has been in service with Sabena Belgian World Airlines since last month. This latest stage on one of the French aircraft is powered by Rolls-Royce Avon Mark 511 turbojets. Sabena's configuration is 65 tourist, 12 first class. The airline has ordered six of the planes, received three.

the terminal. And some of the flights involve stops before final destination. However, the airline says that every extra hour on an intra-fleet aircraft means a saving to the passenger of \$0.2. The airline's philosophy, its officials say, is "percentage on the belief that speed is the best ingredient in transportation, as has to be."

Lehrdrake isn't too worried about the possibility that IATA carriers will go to a ten loss for his and into a new layer of the insurance travel market. For one thing, the other carriers are thoroughly committed to it, are going to have to fill them and pay for them, and aren't likely to go back to entire pricing services. Lehrdrake's highest level of commitment and low cost operation, its officials say, should make it possible to undercut whatever fare reductions the IATA carriers come up with and still make money.

At the other end of the scale, low-cost charter operators like Air Europa is a threat to Lehrdrake. This kind of group business has been growing greatly during the past few years, and the nonstop transatlantic has become a member of a group a under \$300 in many cases.

But Lehrdrake officials say the cost, revenue and flexibility of scheduled travel makes up to a great extent for the difference in fare of the charter passenger. Another consideration, of course, is the fact that a charter group is supposed to meet certain requirements including basic fare, reimbursement on a legitimate group for its members. As a result, Lehrdrake estimates the market for low-cost charter is not growth minded than this competition.

To foster the growth of European tourist traffic to the U.S.—and end starting considerable attention in the travel field, Lehrdrake plans to recommend to Civil Aeronautics Board and the Department of Commerce that

tourists holding foreign passports be granted special rates on U.S. domestic airfares at off-peak times. These fares would be 50% of published tariffs.

Lehrdrake operates 30 domestic routes, but the other Lehrdrake carrier, Interjet, operates not only in Mexico, but in the other hemisphere, between Mexico and Europe. Lehrdrake now has 100 aircraft in its fleet and Douglas DC-9s on three flights.

Lehrdrake Airlines plans to offer eight weekly round trips between New York

and Europe, five summer with its DC-9s, one more round trip than was scheduled last summer. The aircraft can hold 93 seats in rows of two and three abreast.

Maintenance is performed by a Norwegian airline at Copenhagen, and the leasing company generally is left to more maintenance matters in its home base at Reykjavik, and to do the work itself.

Plans of Lehrdrake's aircraft are U.S. trained and U.S. pilots provide check service periodically. Crew numbers seven, including three stewards.

Greater Use of Examiners Urged To Reduce Regulatory Backlog

Washington—Senate Judiciary Committee last week urged an increase in the power, prestige and compensation of federal examiners and auditors to reduce the growing backlog of business at Civil Aeronautics Board and other regulatory agencies.

This followed a recommendation in the President's message to Congress on regulation agencies (AW Apr. 17, p. 41) which called upgrading the compensation of hearing examiners through higher pay and better selection criteria.

The committee, headed by Sen. John Carroll (D-Colo.), commented in a report to its subcommittee on consumer protection that "the review of structure available for a concerted effort to eliminate backlog and delay in the administrative process is the utilization of the hearing examiner."

The committee recommended that the hearing examiner be granted increased authority to extend the course of hearings.

The report called for legislation "which will not only permit, but require, the full utilization of the potential of the hearing examiner corps."

It observed that "agency control of policy can best be achieved by retaining the principal officers of the administrative agencies, while leaving them to consider and formulate standards of principles of general policy."

One specific suggestion was to give examiners considerable authority to hold public and legal hearings.

Other recommendations included the following:

- Increasing the membership term for all regulator agencies to ten years. CAB members now serve two years. If a new President were confirmed with a majority of their Board members, the majority of political party, the committee said, should be permitted to replace the one whose term is about to complete. But the report said the committee does not support the proposal of having his term three. The committee recommended an increase in the retirement benefits and salary of Board members, as well as hearing examiners, but did not specify how much.

- Enforcement of ethical standards. One proposed bill would require the President's authority to establish ethical standards for government officials and apply such standards to non-regulatory agencies. The problem is to varied, the committee said, and that an attempt by Congress to enact details would be frustrating and cumbersome. The second proposed proposal would establish a pilot and research stations for participant-government employees as private representatives—in a public or "backdoor" approach—concerning pending cases.

- Establishment of an "Office of Administration and Reorganization" in the White House to oversee management of the regulatory agencies. A similar recommendation by James M. Lands, special assistant to the President, provoked considerable controversy and was not included in the President's message to Congress (AW Jan. 2, p. 23).

Mexicana Traffic

(Domestic and International)

	For year change
Revenue miles	+ 16.8
Revenue fares	+ 12,029,556
Revenue passengers	+ 61,124
Revenue passenger miles	+ 50,915
Available seat miles	+ 38,697,140
Passenger load factor	+ 65,755,416
Cargo ton-miles	+ 60.6%
Mail (ton)	+ 5,959,545
Available ton-miles	+ 28,936
Overall cargo load factor	+ 79,193
Overall cargo ton factor	+ 64,870
	+ 2.0%

MEXICANA AIRLINES revenue miles on domestic and international routes totalled 12,029,556 in 1969, a decline of 7.4% from 1968. Mexican operating costs (as defined) rose 16.8% and total sales delivery of a 16.8% this summer. This also operates eight Douglas DC-8s using DC-8, 35 DC-9s and three Fokker F-28s. It is expected to shortly place on order for U.S. built jets (AW Apr. 17, p. 41).

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Airline Income and Expenses—4th Quarter, 1960

(IN MILLIONS)

THE NEW FORCE IN WORLD AVIATION

British Aircraft Corporation Has Designed:

- The world's most popular modern airliner—The Viscount.
- The only major European defense missiles—Thunderbird and Bloodhound.
- The Royal Air Force's fastest fighter—Lightning.
- The world's most economic transport—Vanguard.
- The first "second generation" rear-engined jets—VC-10—BAC-107.
- The Allied Nations' most lethal portable anti-tank weapon—Vigilant.
- The Royal Air Force's all-through jet trainer—Provost.

It has been entrusted by the British Government with:

- The project study for a Supersonic Airliner.
- The most advanced Tactical Strike Reconnaissance aircraft ever designed (TSR-2).
- The first all-steel research plane to pioneer the frontiers of supersonic knowledge (T-188).
- Many new weapon concepts which are still highly classified, including Blue Water, the support tactical surface-to-surface weapon for the British Army.

The four member companies of British Aircraft Corporation have, since World War II, built over 6,000 aircraft of all types. This number includes: 600 four-engined Turbine Airliners, 800 Twin- and Four-engined Jet Bombers, 1,700 Jet Fighters, and 1,100 Trainers.



VISCOUNT • V-BOMBER • VULCAN • TSR-2 • SUPERSONIC AIRLINER PROJECT • T-188 • CAPTAINSHIP • LIGHTNING • TSR-2 • JET PROVOST • BLOODHOUND • THUNDERBIRD

VISCOUNT • VULCAN • TSR-2

BRITISH AIRCRAFT CORPORATION

100 FALMOUTH, LONDON, S.W.1, ENGLAND

	Passenger Revenue	M.R. Rent	Property*	Charter	Freight Revenue	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
BUSINESS AIRLINES								
Aeroflot	10,028,681	2,276,297	8,693,707	731,312	118,466,422	97,946,913	7,709,401	
Brussels	17,469,100	623,118	917,404	566,449	18,556,441	18,495,760	406,491	
Caravelle	10,514,419	1,000,000	1,000,000	446,454	20,959,447	20,959,447	0	
Continental	14,022,347	284,409	433,859	33,842	15,379,312	15,316,187	672,195	
Delta	50,217,017	470,000	1,730,245	138,120	50,916,334	51,481,497	1,569,116	
Eastern	59,796,000	1,000,000	2,000,000	11,711	64,716,496	64,179,142	546,954	
Embraer	12,549,100	1,000,000	1,000,000	12,549,100	12,549,100	12,549,100	0	
Horizonair	1,208,812	161,144	361,827	26,379	8,416,365	8,409,365	4,936,416	
McDonnell	14,342,100	848,500	1,357,454	999,919	10,375,301	10,375,301	1,320,104	
Trans World	20,177,000	1,000,000	4,204,217	44,828	66,350,124	66,038,034	311,086	
United	101,514,419	1,000,000	4,000,000	713,944	101,514,419	101,514,419	0	
Western	13,458,312	556,300	556,300	150,512	15,647,496	15,647,496	391,097	
DEFENSE AIRCRAFT								
Aerospatiale	5,142,379	14,063	237,498			1,448,409	2,122,422	-272,713
Boeing	2,378,071	81,720	31,307			2,606,361	2,130,420	346,241
Caravelle Atlantic	720,387	18,816	41,263	4,079		769,401	809,456	-29,957
Deutsche	44,141	3,149	65,114			337,413	378,413	-41,998
Embraer	8,912,610	172,167				10,020,300	10,020,300	0
Messier	101,339					101,339	98,165	2,974
National	4,059,933	1,474	21,003	4,679		406,397	447,020	-37,623
Peruvian	3,426,852	1,000,000	1,000,000	41,711		7,802,400	7,472,400	330,000
Peruvian-Boeing	70,750,703	8,000,000	18,000,000	8,234,300		90,750,703	94,750,703	-4,000,000
Alaska	474,810	55,244	191,704			1,101,399	1,422,399	-319,940
Alenia	32,349,195	3,407,656	1,182,208	766,323		42,368,100	43,407,396	-93,295
Latin American	14,443,000	4,000,000	4,704,200	200,000		16,443,000	16,443,000	0
Peru	10,000,000	3,439,440	9,723,300	8,697,121		20,000,000	20,436,564	776,225
Perseus	4,043,421		110,400	181,100		2,381,402	2,411,913	-30,511
Ross						49,494	56,419	-66,925
Trans-Andean	349,401		66,000	31,272		49,494	56,419	-56,419
Trans World	10,127,813	3,409,212	1,192,212	1,087,214		21,612,203	24,495,300	1,883,097
Dakota	6,075,813	126,791	130,100	26,556		8,054,419	8,379,300	-357,471
Western	1,150,312	11,312	26,556			1,213,376	1,236,471	-23,093
LOCAL AIRLINES								
Air Republic	1,161,201	8,802	28,272	13,008	151,300	3,113,320	3,944,320	-830,400
Caravelle	1,002,803	10,300	30,400	731,761	1,002,803	1,002,803	0	
Central	1,611,603	20,269	115,231	39,711	1,199,761	2,376,218	2,213,223	107,714
John Cossel	707,708	11,840	28,388	4,870	1,003,107	1,306,388	1,101,203	146,263
Netherlands	2,012,000	41,363	64,637	110,270	1,438,458	4,466,795	7,735,549	-669,750
Scandinavian	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	0	
Swiss	1,995,401	44,000	120,201	48,470	1,995,401	2,041,417	1,976,794	93,284
Tentac	1,379,104	40,647	37,037	165,336	1,367,820	3,049,365	9,961,319	-959,357
Transavia	1,894,305	31,364	78,844	76,320	1,003,380	3,135,833	3,100,492	113,437
Trans-Canada	1,200,000	20,000	40,000	1,200,000	1,200,000	1,200,000	0	
Trans-Texas	2,092,400	44,000	41,101	35,467	2,092,400	2,729,375	1,188,219	618,846
West Coast	1,900,707	31,181	41,231	3,497	1,180,711	2,762,333	2,688,140	428,822
REGIONAL AIRLINES								
Alaska	1,064,419	8,215	34,174	1,298		1,122,383	1,269,420	-22,037
Hawaiian ²								
CARGO AIRLINES								
American Red Cross ²				2,607		128,208	127,422	36,481
Brilliant	30,422	3,101,400	6,410,441			8,116,400	7,113,379	814,867
Embraer	36,181	1,116,400	836,370			1,003,700	2,348,338	-216,130
Scandinavian ²				1,034,848		1,034,848	1,034,848	-100,000
MILICITARY AIRCRAFT								
Chilean Helicopter	432,500	8,370	3,373			396,637	320,710	99,319
Embraer	14,201	20,370	30,104	1,138		378,869	366,995	62,073
New York Airways	320,137	11,795	18,440	11,304		281,007	160,446	160,586
ALASKA AIRLINES								
Alaska Airlines	951,103	161,749	208,798	854,204	682,821	3,120,928	2,240,476	68,450
Alaska Central	72,100	20,370	30,104	1,138		207,052	160,446	46,446
Caravelle	44,250	35,101	40,105	55,109		320,848	320,848	0
Ela	134,448	14,102	17,438	2,461		178,567	238,438	-59,870
Wes	1,000							
FLIGHT CARRIERS/ATED¹								
Pacific Northwest	1,467,313	303,272	384,704	6,430	472,710	2,444,376	2,048,897	375,790
Western Airlines	261,416	167,397	187,930	10,348		446,612	454,921	-56,473
Worldwide Airlines	13,100	2,282	2,007	4,340	20,219	46,612	42,981	-12,571
Wing Alana	167,400	127,197	87,401	42,871	406,397	945,048	1,047,380	-126,188
AVIATION AIR TRANSPORT								
Scandinavia ²	10,316	3,382	1,713	17,830		98,191	102,150	-44,160

* Not available. ¹ Property Space includes engine, freight & cargo equipment.

Compiled by Britain Week from 4th quarter to the Civil Aviation Year Book

AIRLINE OBSERVER

► Air Force is trying hard to interest Federal Aviation Agency in using SAGE as defense source for air traffic control instead of the routes FAA is developing for this specific purpose. With the threat of increased aircraft attack rising to a secondary priority, USAF is anxious to get FAA to share the cost of operating and maintaining SAGE. FAA now has a team working on this, making an economic study of the costs involved, and FAA Administrator Joseph Dabbs recently visited Maj. Gen. Kenneth Berg, director, Headquarters for Experimental use of SAGE for high-altitude traffic control in the Boston-New York sector known as Project Safe, and FAA officials expect the experimental use of SAGE for high-altitude traffic control will be expanded and will be expanded to include military control operations by the end of the year.

► Which for a Civil Aeronautics Board ruling that Riddle Airlines' two partnerships merge with American and American and to receive subsidies is not only exclusive. The Board apparently believes the merger with American would increase rather than decrease Riddle's need for government support.

► Federal Aviation Agency report on its tests of best methods for making aircraft more responsive to wind conditions will show that the amount of aircraft surface covered with fluorescent paint is more significant than the picture of the painted surface. The FAA report is expected to be released next week.

► Pan American World Airways, which pioneered airline use of tropo-sounder measurements for extending VHF radio communication beyond normal line-of-sight range, is constructing the first airline tropo-sounder station in the Middle East at Beirut. The station will go on the air in mid-July in two months.

► El Al Israel Airlines is experiencing unusually high load factors on its U.S.-Tel Aviv route. Chief interests, in addition to Passover season and independence celebrations, is the European trip.

► New York Airways will add a cabin attendant to crews on all Venus 109 flights, which are scheduled to begin this summer. Under Federal Aviation Agency regulations, cabin attendants are required on all aircraft carrying 30 or more passengers. The airline probably will use downswings rather than steward for the job.

► Fighting between British European Airways and United Kingdom airline partners continues to escalate. BEA has refused to discuss future relationships with British United, which, with Canadian Eagle, has applied for operating authority on an route to 40 British cities, of which one is Berlin. BEA and British Caledonian Airways Corp.

► Aeroflot's El Salvador has been recommended for a Iata air carrier permit on an El Salvador/Mexico route by Civil Aviation Bureau. Bureau's carrier propose to operate the route with one Carib C-46A, carrying cargo and mail.

► American Airlines will perform maintenance and overhaul work at Tulsa, Okla., base on the Lockheed Electra, Boeing 717 and Convair 580 which are operated by the Federal Aviation Agency to India in carrier inspection.

► Aeroflot has more than doubled passenger capacity on its Moscow-Peking route. Sixty-one passengers B-184s have been replaced by 10-passenger Tu-104Bs, and round trips have been increased from two to three weekly. Other Aeroflot improvements, effective this month, include replacement of bienges with gas-powered B-14s with 11.33 turboprop transports on the Leningrad-Helsinki route. Interim flight frequencies also have been increased from Moscow to Budapest, Paris, London, Cairo, Warsaw, Copenhagen, Amsterdam and Helsinki.

SHORTLINES

► **Boeing** Aircraft has exercised its option to purchase a fourth Boeing 720 B27. Purchase is being financed with company funds with another long-term debt note equity used. Boeing currently has ten 720-027s and it is to take delivery on its third in August.

► **British Overseas Airways Corp.** will operate 358 North Atlantic flights weekly during the June-September period. Total of 17,000 seats will be offered each week on the route between the U.S. and Europe by BOAC.

► **Continental Airlines** common stock has been accepted for listing on the New York Stock Exchange, and trading will begin about mid-May. All transfers are now listed on the New York Exchange except Northwest, which is listed on the American Stock Exchange.

► **Deadline** for Emergency Board report to Pan American on the dispute between Northwest Airlines and its flight engineers has been extended from April 24 to May 28.

► Domestic trademark offices on debt rose to \$44.4 million in 1966, compared with \$32.3 million in 1965 and \$24.4 million in 1964.

► **Federal Aviation Agency** has an agreement with the Air Force that will permit civilian air traffic control members to take photofluorescent strand training. Basic course includes atmospheric physics, physiology of response and orientation, hypoxia and effects of altitude changes on the body and principles of time.

► **Hong Kong, Indonesia, New Zealand** and the Fiji Islands have agreed to take steps toward creating common air and customs and type fair for passengers and cargo. Change was made as a result of proposals by International Civil Aviation Organization and later International Air Transport Assn., which are encouraging in themselves of border control processes.

► **Post Office Department** has proposed new postal rates which would increase air mail rates from 10 to 15 cents per half ounce between the U.S. and South America and from 10 to 15 cents between the U.S. and the Caribbean and Central American area. Since 75% of the land area of the Soviet Union is in Asia, the Asia rate of 25 cents per half ounce would apply on all letters to Russia, other than the 15 west European area and for the western section.

MICRODOT Expands Telemetry Capability

South Pasadena — Microdot Inc. has recently acquired Spectralis Instruments Co. of Massachusetts, California. The acquisition provides Microdot's Instrumentation Division with outstanding capabilities in the field of UHF and UWB carriers and related instrumentation. Spectralis has been widely noted for its most significant breakthrough in the new UHF telemetry field with the first operational UHF telemetry transmitter, and for its high power transmitter designed for the Pioneer V satellite. Spectralis Instruments have also flown in the Edisto, Jupiter, Atlas and Pegasus missiles.



The Pioneer V transmitter shown above is typical of the sophisticated instrumentation now offered by Microdot. This miniaturized unit features an output of 250 watts, ease of adjustment, and proven outer space reliability.

With the Spectralis acquisition, Microdot's telemetry capability now includes a broad product line ranging from sensing devices through transmitters. As a single source for instrumentation, Microdot can provide reliable strain gauges, load cells, temperature probes, thermocouples, amplifiers, power supplies, signal conditioning equipment, power amplifiers, frequency doublers, oscillators and transmitters.

MICRODOT INC.



220 Pasadena Avenue
South Pasadena, California



"MAKE A NOISE IN THE EAST, BUT STRIKE IN THE WEST"

Mao-Tse-Tung's arsenal is impressive: 700-million expendable people. And soon, nuclear capability.

To those of us in the defense business the prospect is worthy of sober consideration. We cannot match Red China in expendable human lives. Instead we must rely upon the effectiveness of our defense capabilities to keep fingers off buttons.

The responsibility is clear. The next business of the defense business is survival.

Aerospace Investment Abroad: Part I

U.S. Firms Reappraising Foreign Licensing

By Cecil Brewster

General U.S. aerospace industry's marketing planes into the European market is strong, long-term, an coherent or is the drive for short-term profits simply creating a shift, possibly induced by competitors who used to be unknown with tomorrow?

This is a question being asked in industry financial circles today and that results probably around the same of how U.S. firms can make themselves a place in the market as a commercial launching pad for the rest of Europe. Europe's industry absorbs the expanded technology it needs to stand alone.

What for instance are the relative potentials of license agreements as opposed to U.S. stock holdings in European firms and wholly-owned subsidiaries or joint-venture companies and research institutes, parts with their minimum outlays of capital?

To gain some insight into these questions and the increasing importance from Europe itself—Aerospace Week interviewed industry in 15 European countries as well as those of the U.S. to the international government and trade executives officials on both sides of the Atlantic.

The picture that evolves is that no means a clear use over the short, most profitable route to the market is still a source of open debate within the U.S.

and among representatives of U.S. firms abroad.

The old saw, "sell your license, sell your soul, no longer holds," one American representative in Europe says. "Name, it's big business."

"You sell a license," another comments, "and you still own it."

What you are doing is building up a firm that can be damaged through competition in the next go-round.

A program of wholly-owned subsidiaries, however, will accomplish what is desired if the product offered is to be properly marketed and if full advantage of its sales potential is to be obtained.

"You only establish a subsidiary in an area where you know the market is good but when you move into a place you need complete control to protect your investment."

These are the themes and they are often overlooked by practical accountants.

As an example, a company may form a joint venture firm with a license agreement, and find itself in the position of having to part with its interest if joint venture is to result in a conflict with the U.S. government or a prime contractor to which it supplies components.

However, the trend of most U.S. firms being entrenched in Europe seems to be a gradual evolution from outright license agreements, with few strings attached, to the purchase of sub-

stantial minority stock holdings in protecting firms abroad, on a cost basis, the sole establishment of profit-oriented companies.

This will, one spokesman says, not have a badch. A license agreement is a simple deal.

Be that as it may, license agreements still hold some—and probably will for some time in cost—and whatever long-term value to the house, they must be avoided with having placed a holding company in the interests of stockholders of the firm at the end of World War II.

License agreements from the U.S. to Europe have predominated but, as the industry on this side of the Atlantic grows through more and more being negotiated between the nations of Europe, both in a free-to-free and more to more-to-base basis, "Anti-trust" regulations among U.S. industry, point to the latter need as a possible portent of things to come with a conflict line in American firms seeking short-circuiting protective steps to follow.

Present U.S. license law rules and regulations are being re-examined and clarified by the newly-established multi-national European production program for Lockheed's F-104G, to replace eight Lockheed (AWM) 33, p. 256) to operational agreements for America's aerospace systems and space partnerships in the area of the world.

The also furnished the present technological leads and immediate goals within Europe—and to this day, a half dozen who contend that the present word of license is the least possible, most cost effective way to do the required and agreements with SEPR, the French rocket concern, signed by North American Aviation's Rutherford, Duane and Thielbar Clearance Corp.

The following breakdown, while not necessarily representative, goes some distance to the range of contracts after license agreements floating from the U.S. to Europe, including consortiums such as the F-104 project and projects handled through or by firms that are wholly-owned profit-oriented companies or those in which American industry has substantial stock holdings.

• **Licensing Division of Avco Corp.** production rights to Germany's DASA (Dornier) for the GO-4590/B2000 fighter/capable. Under the financial plan,

which is now being extruded, DASA pays a fixed licensing fee plus royalties on cargo, and space sold.

• **North American Aviation**, space and modification rights in I.M. and ATC aircraft in Contractors' Aeromarines S.A. (K.A.S.A.) in Spain. Total of approximately 1,800 U.S. Air Force aircraft is involved in the agreement.

• **General Electric Co.'s Flight Propulsion Division** production rights to de Havilland Propellers Ltd. for the T-38 aircraft production assistance.

• **Continental Airlines and Engineering Corp.**, exclusive rights to Rolls-Royce for all Continental engines, space in Europe and to Rolls-Royce-Nestor Contractual engines in Australia and New Zealand.

• **Douglas Developments, Inc.**, a Grumman Aircraft Engineering Corp. subsidiary, production rights to the Italian shipyards Cantieri del Tirreno for the construction of large Lockheed C-141.

• **Lockheed Aircraft Corp.**, production rights in Air France and Deutsche

• **Thompson Products, Inc.**, production rights to Fiat for refrigeration parts.

• **Sikorsky Division of United Aircraft**, maintenance and inspection rights on Sikorsky metal bonded blades in Europe to Holland's Royal Netherlands Aircraft Factories Fokker.

• **Douglas Aircraft Co.**, technical assistance, agreement with IRI's Prague for development and marketing of sub-space-paved electronic terrain systems.

• **Pratt & Whitney and Allison Corp.**, production rights to Italy's Snamprogetti for C-101 aircraft space parts.

• **Sikorsky**, production rights to Westland Aircraft Ltd. for the S-18 helicopter plus a technical interchange agreement. Westland also has 50% of Sikorsky S-61 and S-65 under license.

• **North American's Rockwell Division**, technical assistance agreement with Rolls-Royce Ltd. plus production rights for certain rocket motors in connection with Rolls-Royce's Blue Stock

lifelines for testing and certain space for the Concorde Transport aircraft.

• **Lockheed**, production rights to Hawker Siddeley Electronics Systems for private electronic systems and marine load switches.

• **Bell Helicopter**, production rights to Italy's Comitato Aeronautico Generale Agreements for the Bell 47 and ATC helicopter plus HU-16A training components for the Agusta 162.

• **Bell Aerospace Co.**, technical assistance to the German Group of Messerschmitt, Heinkel and Bölkow working on a Mil Mi 3 V/STOL. Assistance includes primarily round the Mil Mi 8/17B which reached the mockup stage before USAT development funds were cut off in 1970.

• **Boeing Aircraft Corp.**, marketing agreement with SEPR, France which the French firm is converting the Boeing 707 aircraft to serve as the Transonic Advanced Aerospace program.

• **Lockheed**, mutual agreement with France's Bouygues for repair of North Atlantic Transocean aircraft.

From the standpoint of immediately comparable profits, signoffs of the U.S. industry have, of course, found greater laurels in the European communities that have funded together through necessity for the production of such complex weapon systems as the F-104, the Hawk, Chinook and the SideWinder anti-aircraft missile system.

In the F-104 program, Lockheed is supplying a total of 120 aircraft directly to West Germany down to U.S. standards. Production of the 120 aircraft is to be carried out under a further contract for another 100 aircraft, planned scheduled to be built in regular European batches.

North American Aviation will collect on direct sales and license rights to its NASA/JPL for control systems for the



MESSESSCHMITT production lines are turning out weapon system components under license from both the U.S. and Europe. German technicians (above), are installing a forward fuselage section of the Lockheed F-104G.



WORKMAN at Messerschmitt's plant puts finishing touches to a Fiat G-91 fighter aircraft.



COMMON EUROPEAN production of a European design, a probable product of things to come, is exemplified by the Breguet 1040 Avroport ASW. A SAID project, Avroport components are being fabricated in the interests of four nations. In the picture above, the midwing section of the first prototype is being assembled to the fuselage.



Piercing the plasma sheath...

When ICBMs, satellites or space probes re-enter the earth's atmosphere, frictional heating is so intense that air surrounding the vehicle becomes a "plasma sheath." This acts as a barrier to conventional radio telemetry. AVCO/RAD has developed a Direct Re-entry Telemetry (DRET) system for the U. S. Air Force. The DRET system has been flown on Atlas and Titan ICBMs and has successfully transmitted signals to airborne monitoring equipment. Engineers and scientists at AVCO/RAD are also working on techniques for continuous communications with re-entering manned vehicles, as well as on other conditions



Astronauts are using tracking beam of America's map receiver, mounted on Astro-Mars 4 re-entry probe (bottom) launched by Triton 100.

in which a plasma barrier exists and where signal penetration is required.



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AVCO CORPORATION'S RESEARCH AND ADVANCED DEVELOPMENT DIVISION, WILMINGTON, MASS.

F-104 as well. General Electric, on Euro-pace production of the F-104, participated. A number of other U. S. suppliers also stand to profit handsomely.

Airbus from providing the European firms involved with a major opportunity to take a long step forward in improving their technological and production capabilities—and possibly winning foreign competition for the U. S. as well as the T-104 program is contributing much toward helping some of the firms involved in a sound financial basis today.

Major aircraft contractors include Germany's Messerschmitt-Bölkow-Blohm, Dornier, Siebel, Focke-Wulf, Flugzeugwerke Münchener, and Wiesbaden; Holland's Fokker and Avroplane; Belgium's VFWA and Avions Fokker; and East and West Germany. Prime aircraft manufacturers are Germany's BMW, DASA, and Dornier; the Belgian FNW Works and Fiat. From here, the subcontractors flow deep into the hierarchy of the quality contractors of the nations concerned.

Holland's Aviairde is an example of the program's impact: estimates that its contract will be worth \$25 million, and that it will represent 65% of the company's gross income during the five-year period it is in force.

Technological focus

The Dornier and Bölkow programs are performing similar functions: launching modern European technological know-how, providing added profits for U. S. concern. And, more, military production of American aircraft may be in the offing.

Elsewhere are under construction includes Germany's Reichenbach aircraft-antennal weapons for the industry; the Avon Martin Pershing tactical stage missile and the Czech Vought Scorpion long-range space booster.

The contractors, however, are also providing them their hardware to the point of entry into the atmosphere of the lower earth, where the former loses much of the data to radio control of its product.

Another matter of debate is just how much progress should be encouraged in ballistic, earth-orbitation projects, as in the case of the J-104 and Bölkow's, as an official NATO committee. Proponents of the latter argue that the division process and chain of command is strengthened, and that a program is effective in the NATO model; its opponents see NATO participation model adds another level of bureaucracy, and otherwise.

The Bölkow proposal is a "subsidized body" of the NATO, as arranged, divided by the NATO. Bölkow presented arguments, valid in representation of all the nations concerned.

Under review at the NATO re-

quest is Battison, Aérospatiale, and after U. S. firms, European companies of five nations have banded together to form a French incorporated production consortium known as Societe Européenne de Télépilotage (SETEL) with headquarters in Paris.

Participating European firms, each with component and subsystems or responsibilities, are Aérospatiale de Construction Electrique de Châlons (ACEC) of Béziers, Thomson-Houston (GPTD) of Paris, Téléfunkens of Germany, Telecommunications of Italy and U. S. Philips of the Netherlands. SETEL also has undertaken Hawk motor production to the Ministry des Armées, Direction des Poudres, of Paris, and Acrosuisse S. A. of Raron.

Prime European contractor for the multination: Bölkow's program which bears the least designation of a "NATO-sponsored project" in the flag.

Germany's Bölkow division of Bremen aircraft, Pielan-Elster and Co., a German subsidiary of Pielan Elster.

Full list of participating firms has not yet been disclosed since some 300 pending contracts clearance before final contracts are signed.

Time at the program however, in due, Belgian's Los Angeles of Antwerp, Germany's Dornier-Mitsubishi, Czechoslovakia's Slovenske Zavody (SZE), Philips of The Netherlands, Norway's Kongsberg Vapenfabrik, and Russia's Aviamashinostroyeniye and Putilov's Special Electrics, a division of International Telephone and Telegraph Corp.

"Most of these people are eager to work with us. They know this is taking a long step, and they want to learn," says U. S. representative Andrew Carr. "But," he adds, "you run into others who think they know everything there is to know. You can't see over these that it is a fairly big step beyond anything that is done before. They just stand back."

Overall extent of the U. S. industry's involvement in launch, track, landing, a almost anyone's guess. Most firms are wary of discussing license agreements, much less capital outlays involved in stock purchase or establishment of a subsidiary, for a variety of reasons—competitive and otherwise.

This general reluctance was already highlighted by the response in an Aerospace Industries Assn. suggestion to its industry members that a dozen of their foreign counterparts be contacted as a reference and benefit to all. Most members simply declined to reply.

The majority of those that did reply expressed opinions that were less than enthusiastic, and the tentative plan was permitted to die quietly.

Industry commitments abroad,



Engineered Environment

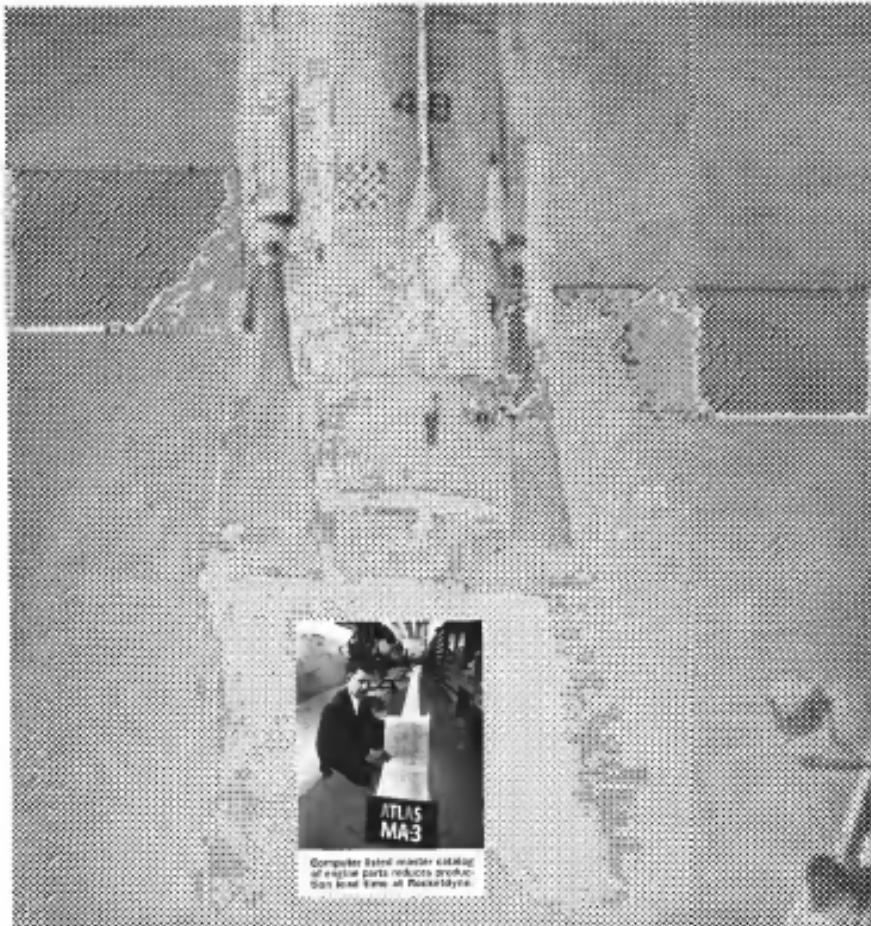
Although universities to host, the spirals can now furnish a cooling bubble bath and thus "infect" the environment to melt ice needs.

"Estimates that investment in a viral equipment that can be built into today's weapon systems. Assessing the cost is specially designed AAF equipment for controlled environment. For example, AAF-sponsored air conditioners were developed for the Apache system. The system is designed to withstand the severe environment of the Atlas missile. They provide conditioned air to personnel and for sensitive electronic equipment in the van.

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whether they border upon a question of security or not, generally what he desired through the State Department, which he had to do. In the matter of foreign currency, whether the Department of Defense at the Commerce Department, depends upon their nature.

These agencies, however, insist that as much as is feasible or minimum in these, adding that any attempt to monitor the requests of such a basic law for a U.S. behind the purpose of their operation and violate the right of the corporation involved.

"The internal Revenue people are the only ones who might be able to come up with a figure," a Commerce Department official said, and revealed, "We don't have it, and we couldn't look at the tax records if we wanted to."

But the constraints are growing and are often farreaching over. In Europe, they are being posed in scope by agreements between the nations of western Europe with little or no U.S. involvement.

Germany is building the Fiat G. 91 close-support fighter, Bölkow and M.A.N. Maschinen Uetzen, Augsburg-Nürnberg are cooperating on the development of high-performance VTOL prototypes. W.G. Armstrong White erds in Britain and Saab Aeronautics in Sweden are producing supersonic target drones developed by France's Nord Aviation. Spain's C. A. I. is building Dornier Do. 27 helicopters. Klocke-Hirschfeld Dests is building to build Borsig-Schäffer's 5,000hp thrust Dylex turbojet engine for Germany's proposed G. 91.

Potez Av. Faugn's Magister jet trainer has been produced under license in Germany (as a part basis) by Messerschmitt and Bölkow-Borsig (W.G.) and Dornier-Kronach (Germany) and Focke-Aerospace Co.

Working within the framework of NATO, Dassault, Fokker, SABCA and Avions Fairey are jointing France's Dassault in production of the 1150 Atlantic ASW patrol plane which will be powered by two Bölkow-Borsig Tarns turboprop engines. Nord and Germany's Hamburger Flugzeugbau are building the first prototypes of the Travel G. 160 turboprop transport scheduled to replace the post-war Douglas C-47, also built on a compensation basis by the two firms plus Fagron Nord.

Rightly and rightly agreements within and outside the scope of NATO are going at a remarkable rate, a manifestation of Europe's desire to build its own whenever possible.

Germany, with the money to spend but without the facilities and technology to satisfy its own, is the current leader in this area, manufacturing parts with Great Britain for a VTOL

that support fighter. At a present NATO requirement, another with France for a high-performance VTOL interceptor to meet a NATO requirement it hopes to generate, and will affect the United States. This covers a major spectrum for development and production of a family of interceptors.

This determination is spread in many ways over spans with advanced designs of products that bear the imprint of German development with the major mass behind recent and substantial U.S. investments in the country in the form of stock purchases and establishment of joint firms.

The Germans' U.S. representatives here say, "we have our own problems and they want to deal with Germany down whenever possible. This'll work under a license when that's how to do it, but the way to do all this can be done." This is another a German stamp on the rad product."

Worldwide a truly European space effort moves beyond the paper stage, the overwhelming need to pool available technological and facilities resources will take precedence over autonomous development in some quarters for individual programs.

The European nations, however, are split as in the objectives and breadth such a project should have. For the moment, this most probably will continue to look to the U.S. for the corrective booster system while developing their own payloads for planetary and research purposes. This need not and should change if and when a more comprehensive program for the Soviet becomes a reality and production is begun.

Such splits generally have long political overtones, and the rag between Common Market and Eastern Europe considerations, the economic sphere is sometimes left without enough latitude to overcome the subtleties of social and political advantage.

Sweden is, as an example, aligned Sweden and Dassault. Both parties have fully committed to the conversion of a new jet fighter. Sweden's gamble on its class-new and a good product, paid off hands for the Saab Draken. France's Common Market partner but with half reductions in effect, pushed just as hard for the Dassault Mirage III C and now.

As in the case of the U.S. agreements, the European defense parts are the technological general and include the following:

• Be-Bradford Engine Co., Ltd., production rights for GKN and GKN's propulsions to Bölkow's S. I. C. M.A., Sweden's Faugn and Sweden's Saab's Svenska Flygmaskin, Malmö.

• Puglia, production rights in Focke-Wulf for the F.104 jet trainer for the West German air force. Focke-Wulf



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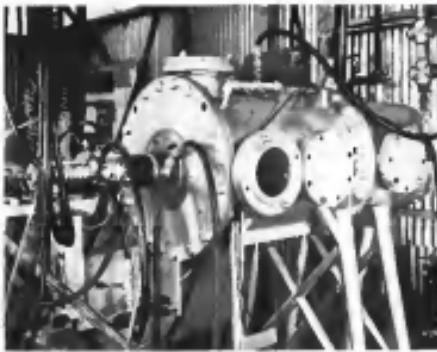
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Hyperthermal Tunnel Marketed

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Boeing P-1496 are pursued by licensing engineers produced under license by BWI. Technologies

• France's Turbomeca, production rights to Hispano-Suiza engines. Hispano-Suiza is a range of aircraft gas turbines. Block 1000, which the producer presented to the government, Hispano-Suiza 50% and 90% of its current business. Part is intended to expand next year but not be renewed.

• Bristol Siddeley Engines, Ltd., production rights for turbolad, turbos, no. 900. Armstrong

• Bristol Siddeley, production rights to Dernier for the VJ. D. 10 Viper powerplants.

• Italy's Officine de Bresciano, production rights to Cermes and Merkle. Eng. Ing. Societa Gavill for the M.D.B. 32 Armstrong powerplants.

• Bristol Siddeley, Ltd., production rights for drop tanks to Belgian's SABCA.

• Dunlop Rubber Co., Ltd., production rights to SABCA for tank coated equipment for Belgian air force Avro CF-100 and Hawker Hunter aircraft.

• Italy's Aviamilano, production rights to its competitor Aviamilano for the F-104, IL, aircraft plane.

• Switzerland's Cetos, production rights to German's Bölkow for the Cobe aircraft model aircraft.

In the engine field, Rolls-Royce now holds the lead and, with a balanced assistance agreements on advanced

projects, is working to keep it despite some loss to others (Italy, U.S. and French manufacturers). Above agreement with the British government

• Rolls-Royce, Ltd., a Power Board for production of the Avon R.R. 10, R. 14 and RA 28 turbolad engines in Spain and France.

• Belgium government for production of the RA 10 and RA 28 in Belgian FN Works.

• France's Hispano-Suiza for production of the Avon and Dvce engines. The Hispano-Suiza Type will go into the French Grumman Tornado.

Interspace Role

An increasing European role is a natural consequence of its technological strength on a broad front, but U.S. industry officials at governmental meetings are plugging their efforts to battle these firms on an equal basis.

The zone of an application is a U.S. firm requesting permission to grant a license agreement is often long and various. Some disappear into the maze of government channels for periods ranging up to eight months, or longer if a final go-ahead is not given, according to industry spokesman, and by that time, the British or French have moved on in and seen up the deal. He adds:

"A large company with a Washington representative can often get things

done fairly fast, but 1 p.m. the next day who doesn't know anyone and has to work by mail or telephone."

Under current procedures, the application is submitted to the State Department, which then passes it along to the Defense Department's International Division for Security Affairs for consent if it deals with military hardware or to the Commerce Department if the product involved is of a purely commercial nature.

Defense Department, if it receives the application, then passes it along to the referenced service for security screening, and thus, a U.S. representative in Europe will "see whatever gets submitted."

"We have a device that SHAEF (Supreme Headquarters Allied Powers Europe) has 10 years old. So we went back to Avro to get it for clearance," he says. "SHAEF could have taken it all right but not from Avro since it's still classified. The trouble is the earlier work was written down since Avro and BAC. B."

"We've gone back and told the people at SHAEF what the Avro first did, and then to Britain. So we're just standing back now letting SHAEF and the Avro take care of the legal business."

Once the individual service has had their say, an application is passed back to the Defense Department, then to the After Action, and then to the State Department, again, above all other European organizations, it's weighed for its political implications, good or bad.

If the request has passed all the necessary hurdles, the applicant then receives a formal letter from the State Department giving him the go-ahead to conclude his agreement. The approval, however, is restricted and tightly controlled.

Eventually we want to make a modification in a piece of equipment or create a state-of-the-art improvement, we have to go through the same process all over again," says a different aerospace official. "And the same goes if we want to sell it on a commercial basis to another customer."

British spokesman in Washington are working toward, and hoping for, a change, particularly in areas where security classification is not involved—the British can practically sell something off the drawing board while it is around nothing.

They aren't accepting lets, however, until they will be successful.

(This is the first in a series of articles dealing with U.S. industry and license agreements with Europe. The second article will discuss the increasing competition from European firms. Subsequent articles will deal more fully with U.S. blockships, joint-venture firms and sales offices abroad, their effect on the "old-line" firms and the name of the European industry in U.S. markets and elsewhere.)

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Unstructured record of vibration test on 30 transistors, each curve in its own circuit during test.

The customer's quality requirements were stringent (AQL = 4.4) and the large sample required ruled out the use of an oscilloscope. The three test would have made a battery of scopes and operators necessary; transients defects would be missed due to eyestrain, fatigue, etc.

The Model 1012 Visicorder was chosen for the task as it simultaneously measures and records 36 channels of test information throughout the test period. The Visicorder instantly and directly records transients, no matter how random.

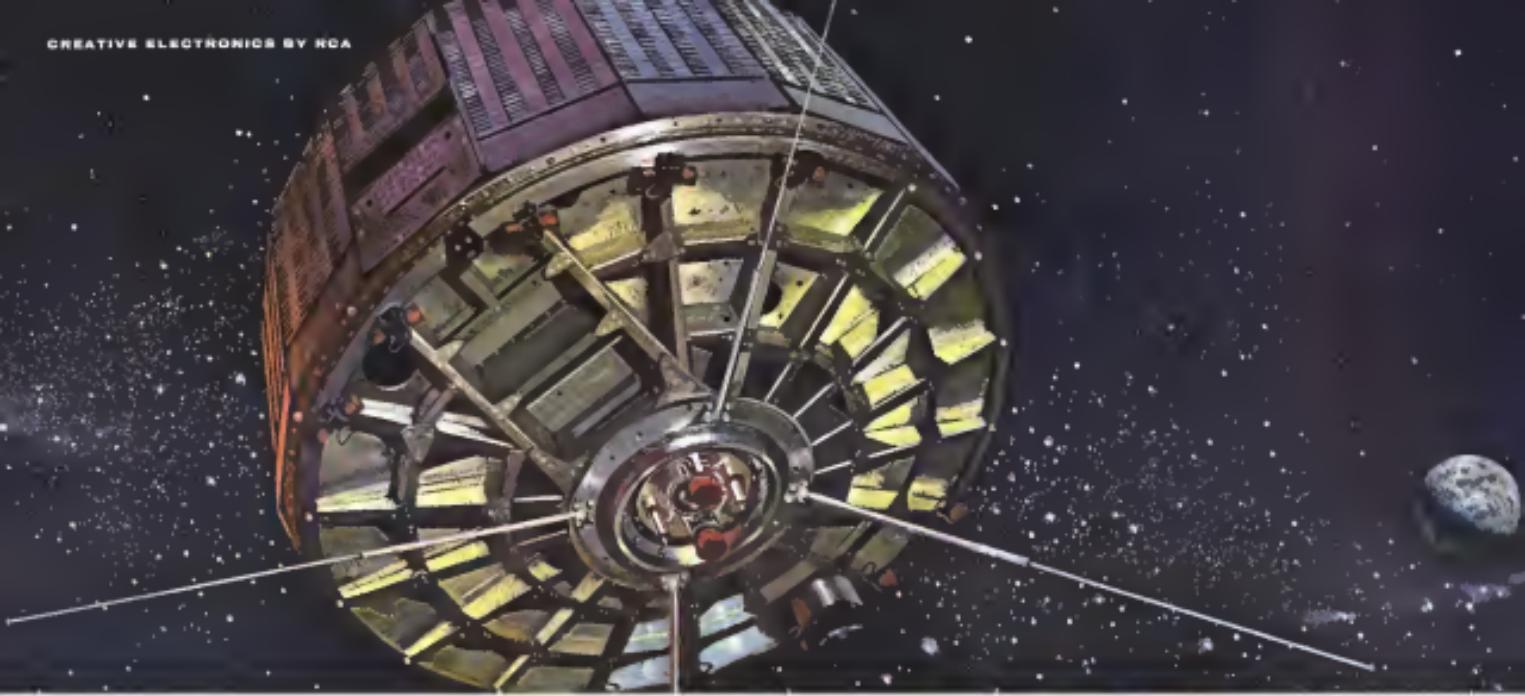
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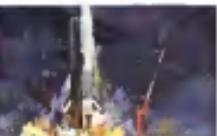
TIROS—RCA Electronic Engineers with Johnson Space Center in the first view of the Northern Lights over North America during the aurora borealis.



TIROS—RCA Electronic Engineers with Johnson Space Center in the first view of the Northern Lights over North America during the aurora borealis.



TIROS—In the Caribbean, down range, made possible by the TIROS system, the "Gulfstream" carrier is shown in the first view of the Northern Lights over North America during the aurora borealis.

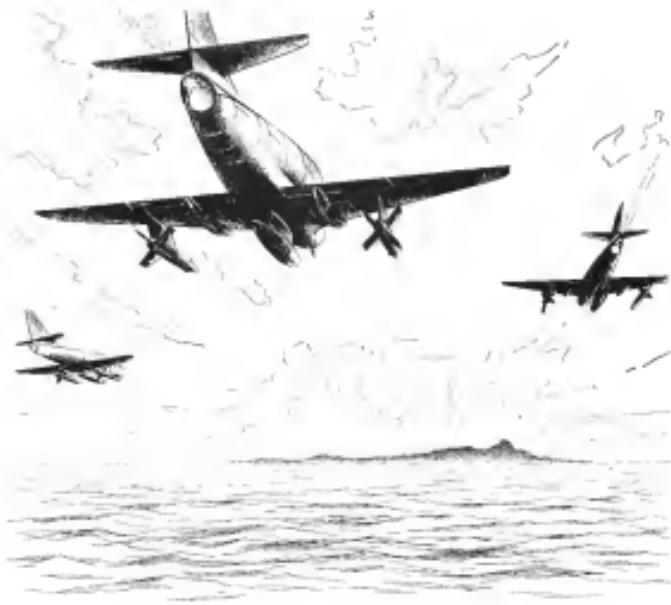


TIROS—In the Caribbean, down range, made possible by the TIROS system, the "Gulfstream" carrier is shown in the first view of the Northern Lights over North America during the aurora borealis.

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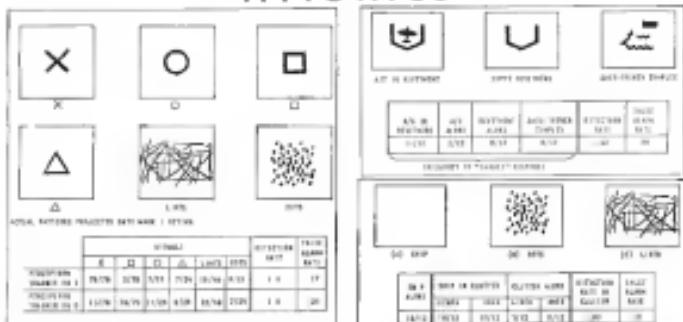
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AVIONICS



SIMPLE targets shown were first used in initial experiments to evaluate possible use of Perceptron type machine to spot targets automatically in reconnaissance photos. Tests conducted at Cornell Aeronautical Laboratory, showed 100% detection of such targets with only a moderate number of false alarms.

LATER experiments used more complex targets shown above. Simple black-and-white images were used because of limitations in AR-10 Perceptron when Machine was run successful in spotting aircraft in overcast and in detecting ship despite presence of clutter, with only modest number of false alarms.

Perceptron Tested for Photo Analysis

By Philip J. Klem

Washington—Recent tests indicate that self-learning machines of the Perceptron type (AWW July 4, p. 72) can be caused to recognize targets of interest in aerial reconnaissance photographs using a system bottleneck to the effective use of meteorological and navigation map information.

Results of the tests, conducted by Cornell Aeronautical Laboratory under Dr. Carl G. Correll, research specialist using the Mat L-1 Perceptron, were reported by CAL's Alfred Meister here during a recent meeting of the American Society of Photogrammetry.

The problem of using effective use of the vast number of photographs obtainable from aerial cameras is pointed up by the 23,000 photos produced in Test 1 meteorological satellite in its last 25-month period of operation.

An analysis of photos produced by a meteorological satellite like the one in Test 1 shows that target and other information of military value is scattered to require tens of thousands of hours for each target the satellite spends over uniformly. *Continued on page 10*

Objectives of the Office of Naval Research sponsored tests was to evaluate the ability of a very elementary, modifi-

able machine to see large quantities of photos containing a few kinds of objects, such as ships at sea or smoke stacks in the Arctic. This is considered only a starting point for more sophisticated machines which might locate special target shapes despite obscuring material or numerous noise sources surrounding the target.

Test Conclusions

Based on the Mat L-1 Perceptron tests, Cornell Aeronautical Laboratory suggests the following conclusions:

- Target recognition is relatively easy and quite reliable when the machine is properly trained. This applies whether the target is alone or in company with other objects.
- False alarm rate can be high for forms which resemble the shape of a target unless the machine is given "negative training" to ignore such objects.
- Machine is apt to be confused if targets and similarly shaped non-target objects both appear on the same photograph.

During a practical experiment, the difficulty in discriminating between targets and similarly shaped non-target objects is not a serious handicap. The major task for automation is to sort

through hundreds of thousands of photographs which are of no meteorological or military value, picking out the tiny fraction of former that are of potential value. This could then be analyzed in human operator.

The important factor is that the machine did not exclude any potential targets, and from this viewpoint the CAL test results are encouraging. *Continued on page 10*

In the initial experiment, CAL scientists caused the Perceptron's photodetector "eye" in N-3000, to scan squares, triangles, random lines and random dots. The eye of N-3000 consists of 400 photodetector cells. In order to conduct the test, two aerial cameras (called Aerials) were divided so that the Perceptron's 240 association units (called Aerials) were divided so that in effect creating two separate Perceptrons each with 120 Aerials. One of the Aerials was trained to identify "X" while the other was trained to recognize circles.

During the course of this experiment, the Perceptron's eye was exposed 75 times to the "X", 79 times to the circle, 24 times each to the square, triangle and random dots and 49 times to the random dots to determine how many times the machine could correctly identify the "X" and how



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often the other symbol could identify the circle. Also unusual was the number of "false alarms," i.e., when the machine thought one of the other symbols was an "X" at a circle.

The machine trained to identify the "X" as a target and the other trained on circles had 100% in spotting over 1000 targets viewed. The machine trained to identify "X's" evinced a 27% false alarm rate, i.e., falsely identifying other targets as "X's." 17% of the time, while the machine trained on circles had a false-alarm rate of 28% at these tests.

The machine trained on X-shaped targets had the most false alarms when exposed to the random lines while the circle-shaped target viewed machine had the most difficulty in distinguishing between circles and squares.

Negative Training

In the first experiment, another of the students was given an "negative" training. That is, during the training, passed the machine a circle rotated 90° so it could identify a "square signal" when it correctly identified a square-shaped target. A "positive" signal was given the machine when it made an incorrect identification.

In the final experiment, a small amount of negative training was given if a machine, on some of the non-target shapes but not circles, negative training on other non-targets according to Matsu. When the first experiments were repeated, the beneficial effect of the negative training was apparent in the reduced false-alarm rate.

However, another mode of operation was devised which gave an even more substantial reduction in the false-alarm rate. This mode is called the "look-for-target mode." It has the human analogy in that people often take several looks at an object in a photographic booth they are able to decide what it is or is not.

In normal operation as seen to the student, image exposure is automatically in response. But in the first 10 looks mode, the screen is exposed to the image, then the image is shifted one reticle position to the right, then one more and finally one to the left. Only after this machine is given these four looks is it commanded to respond and its ultimate response is influenced from the average of the net signal changes delivered to the response unit (R-unit). From such usage, positive (the detailed description of "Perceptron operation" see AW Job 4, p. 72).

A comparison of the value of negative training and four-looks non-target identification in CAEN tests showed the following. The use of four-looks, sufficient over negative training, slashed the false-alarm rate of the X-trained



IS THERE
A FOREST
BEYOND
THE TREES?

The same can be asked of men and their works. In turn, a company is revealed by its products—the signs of a fertile, productive technology or remnants of a declining art.

Fairchild Semiconductor first revealed itself with two diffused silicon transistors. They were different. The technology advanced quickly to the production of silicon transistors that challenged the speed of germanium ... then yielded Planar transistors and diodes where an integral oxide surface achieved a new reliability. Planar in turn has led to practical Micrologic elements and the Planar Epitaxial transistor. Fairchild products have become the most copied in the industry. If you value the satisfaction of working in a fast-paced technology and years is a relevant background, we would like very much to hear from you.



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NEW DORSETT "20" SERIES MODULAR PACKAGING

provides maximum
telemetry system flexibility!

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**SOLID STATE COMPONENTS
AVAILABLE FOR
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- TEC-20 2-watt FM Transmitter, 225 - 360 mc.
- TEC-21 2-watt FM Transmitter, 134 - 197 mc.
- ECA-20 Subcarrier Oscillator
- MVO-20 Multimode Subcarrier Oscillator
- ECA-20 Low Level AC Amplifier
- ECA-20 Low Level DC Amplifier
- PWN-20 Polar Width Modulator
- PPS-20 Regulated Power Supply



MODULAR PACKAGING DESIGN of the new "20" series line of telemetering components and systems lets you fit more telemetering equipment in less space. Every system component has been packaged in compatible modules. Ideal for height (2.37") and width (1.875") with thicknesses of one, two, or four modules (8.75") per unit. These standard modules permit a wide range of system configurations, and make future modification of basic systems easy and economical.

EVERY "20" SERIES COMPONENT utilizes silicon semi-conductor technology—no tubes anywhere. The typical "20" series 12 channel system including transmitters, weighs less than 5 pounds, draws less than 20 watts from a 28 volt supply, and exceeds military specifications for reliability and performance throughout extreme missile environments.

FOR YOUR NEXT TELEMETRY REQUIREMENT let Dorsett take the problems out of system packaging with a "20" series telemetry system. Your inquiries or specifications will receive a prompt reply.

DORSETT ELECTRONICS, INC.

P. O. Box 862, Norman, Oklahoma, Ph. JEFFerson 4-3730



Cook, Electric Co., a facility recently established to serve as an independent test organization for evaluating batteries used in space and missile applications (AVW Oct 27, p. 61).

A total of 86 individual batteries of the sealed, spaceable-electrolyte type used in the tests were divided into eight separate groups, each containing 11 cells. Two of the test groups were isolated at room temperature, each under a different charge-discharge cycle, while the remaining four groups were tested under identical charge-discharge conditions but at an elevated temperature of 125°F. The results were:

- Shallow discharge (100% charge to 75% charge). There was no failure at room or elevated temperature.
- Medium discharge (100% charge to 50% charge). Four failures occurred at room temperature and three at 125°F. Average life of failures was about 500 operating hours.
- Deep discharge (100% charge to 25% charge). Two of the 20 cells in one test failed, half of them were cells operating at room temperature and half at 125°F. The cells tested at room temperature had average life of 490 operating hours before failure, while those that failed at 125°F had average life of 341 hr.
- Multiple-step/Deep discharge (50% charge to 10% charge). Three of 10 cells operated at room temperature failed after about 541 operating



Vapor Thermionic
Converter

Vapor thermionic convertors, which deliver up to 30 watts power and operate at 310°C efficiency at outside temperatures of 1,300°C, has been operated at 500 hr continuously by General Electric's Power Tube Dept. in Schenectady, N. Y. Test data has indicated 30 room temperature-to-1,300°C transition cycles to test its hermetic seal.

**SMALLER, LIGHTER
MORE VERSATILE**



AUTOPOT



**SELF-BALANCING
POTENTIOMETER**

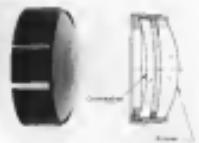
For Flight Test Indication of Temperature,
Acceleration, Pressure, Stress and Flow

Autopot is a highly versatile flight test instrument. Modular plug-in construction permits simple conversion for millivolt or thermocouple use. Unique wire design makes operation completely automatic. Single power source requires no battery or standard cells. Quick change range card and dual face lets extend operating range. Meter size conforms to mil spec for control panel mounting.

Request Bulletin 602 for complete data



A leader in development and manufacture
of aerospace and avionic instruments.



Achromat Infrared Lens

Achromat infrared lenses, covering the 5 to 14 micron wavelength, are now in production at Serr's Corp. of America, supplementing previously available lenses which covered 1 to 6 micron band.

length while two of the cells that failed at 120° had average life of 560 hr.

Original plan is to add an additional 10 model-exchange batteries at first inspections of nine and -30° were selected after preliminary tests indicated cells could not withstand long cycling tests at these temperatures.

Cells that failed under test have been returned to their manufacturer for post mortem examination. The Carol Electric facilities, operating under Wright Air Development Division sponsorship, plans future tests on silicones and other aluminum cells, company reports.

Waveguide Filters Cut Harmonic Interference

New York—Waveguide power filters which effectively reduce harmonic interference in harmonics have been introduced by General Electric Co. Seven models are suitable for high power microwave transmission with fundamental frequencies of from 100 to 6,000 mc.

The filters work on a principle similar to that of a waveguide coupler. Instead of coupling signals at the waveguide window, waveguides link two known signals but still allow the fundamental frequency pass through with undiminished power. Absorption of the unwanted energy.

To guard against microwave testing caused by harmonics and to improve the power handling capacity of the system, the filter is connected as closely as possible to the output tube. It is then connected to other components in the system such as a waveguide switch, a doubler if only one antenna is used, a duplexer if a dual-frequency antenna is used, and the antenna itself.

The new filters cover the S, C, L, and UHF bands, range from 9.7 to 1,200 mc, and cost from \$2,800 to \$12,000. GE foresees no basic difficulty in installing this testing system.

50000 FILTER CENTER

► **Peninsular Recording** Deep-Stereo of employment needs for electronic engineers, scientists and engineers indicates that hiring will be down 30% from 1966. Only 38% of 383 electronic companies surveyed by Division Seven, Inc. electronic personnel consultant firm in Chicago, said they planned to increase their hiring rate. Another 17% of the companies forecast no change while remaining 55% said they planned to reduce hiring by from 10 to 85%.

► **Federal Telecommunications Systems Planned**—Equipment has announced plans for a unified telecommunications system for all civilian agencies to be known as the Federal Telecommunications System (FTS). System, to be administered by the General Services Administration, will be implemented in stages over three one period to increase capability for direct long-distance calling. Another objective is multi-directional routing with multiple routes selected to meet changing traffic needs to bypass such areas. The



Ionization Gage

Ionization gages developed by Westinghouse Electric, provide direct measurement of pressure and densities at altitudes ranging from 78 to 121 mi. and can be built for operation up to 650 mi. Device is a thin-walled version of General Electric ionization gage, consisting of nozzle in which electrons from hot cathode source are accelerated. These electrons pass through a magnetic field to an anode, producing current which is proportional to molecular density. Gage measures 1 in. in dia. and is 7½ in.

long. The anode is made of tungsten wire.



PROJECT NERV



From the last Nuclear Emulsion Recovery Vehicle (NERV) launch and recovery on September 19, 1963, came these important accomplishments.

► **Heaviest Space Probe of a Recovered Vehicle**—The 83.6 lb NERV (37" wide and 17" long) was recovered after a 1200 mile-high flight into the inner Van Allen Radiation Belt.

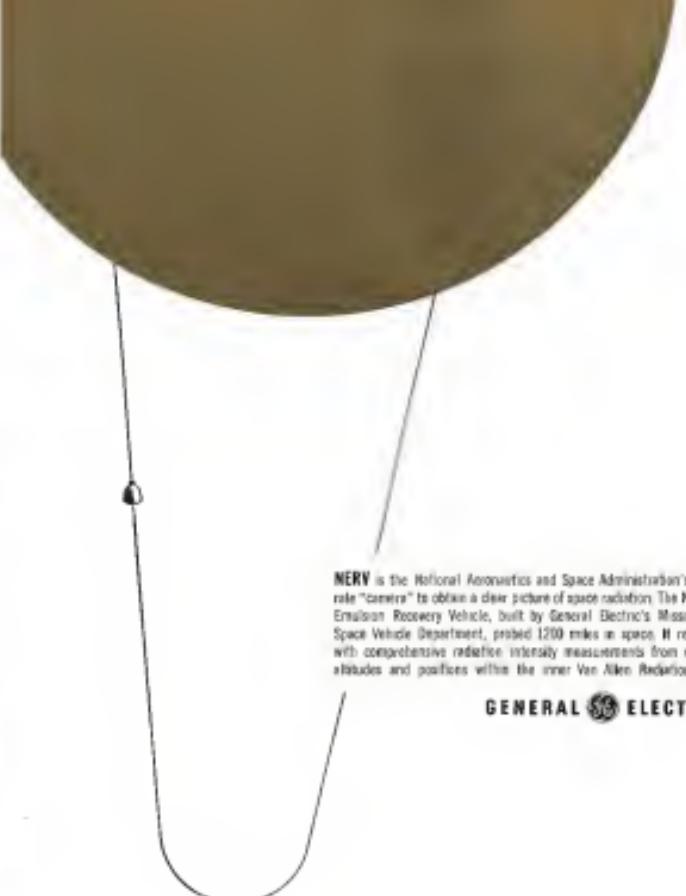
► **Detailed Measurements of Space Radiation**—A disc, 1/2" thick and 37" wide, extended from the vehicle during flight, exposing a stack of 25 layers of special emulsion to the radiation particles. Recovery permitted scientists to analyze the emulsion directly.

► **First Re-entry of a Vehicle with a Recombustible Surface**—The NERV reentry nose cone, intentionally disintegrates to permit exposure of the payload, was the first "hotter" surface to survive the intense heat of reentry. Performance of the vehicle was successful in all respects.

General Electric's Missile and Space Vehicle Department designed and built NERV for National Aeronautics and Space Administration's Goddard Space Flight Center. MSVD is a department of the G.E. Defense Electronics Division.

GENERAL ELECTRIC

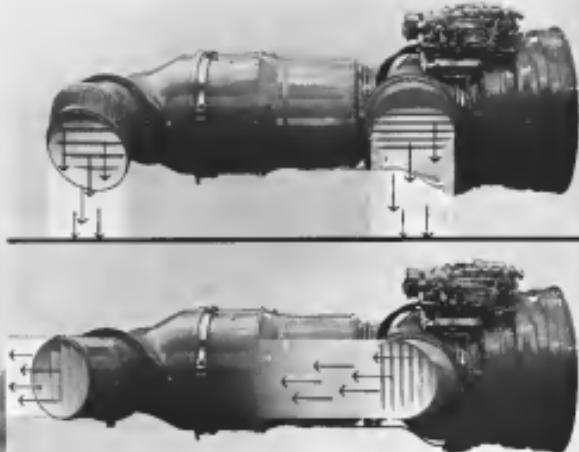
AVIATION WEEK, April 24, 1968



NERV is the National Aeronautics and Space Administration's accurate "camera" to obtain a clear picture of space radiation. The Nuclear Emulsion Recovery Vehicle, built by General Electric's Missile and Space Vehicle Department, traveled 1200 miles in space. It returned with comprehensive radiation intensity measurements from various altitudes and positions within the inner Van Allen Radiation Belt.

GENERAL ELECTRIC

MISSES AND SPACE VEHICLE DEPARTMENT, Philadelphia, PA.



LIFT and THRUST from ONE ENGINE— the revolutionary BS 53 turbofan

The new Bristol Siddeley BS 53 high-ratio turbofan represents a major engineering breakthrough in the field of aircraft propulsion.

Because the BS 53 can be fitted with variable nozzles evenly disposed around the centre of gravity which give directional control to its total thrust, this revolutionary aircraft engine provides the aircraft designer with a single power source for all needs of flight.

VTOL, STOL and normal take-off capability in the same aircraft. Suitable for subsonic or supersonic applications.

High cold-flow ratio gives high thrust for low weight, low fuel consumption and low noise level.

Concurrent installation. Operational simplicity. Independent of all fixed ground installations.

Problems of ground erosion, recirculation and ingestion of debris reduced to a minimum.

The Bristol Siddeley BS 53 has already been selected for, and is now undergoing trials in the Hawker P.1127 VTOL light strike fighter and is supported by the Material Weapons Development Programme for NATO.

For further information, please write to: **Bristol Siddeley Aerospace Limited, 1000 Pine IX Boulevard, Montreal North, P.Q., Canada.**

BRISTOL SIDDELEY ENGINES LIMITED TORONTO—OTTAWA—VICTORIA—Vancouver—SAFETY—POWERPLANT—AIRCRAFT—POWERPLANT—AIRCRAFT AND INDUSTRIAL GAS TURBINES—MARINE AND AIR PROPULSION—MANUFACTURING—POWERPLANT PRODUCTION



Received noise 40 dB at 5 inch distance

For noise of microwave frequencies, too, there's an ideal device in a small package. It's the Litton L-2000 series of miniature gas discharge noise sources. Use them for automatic monitoring of the performance and sensitivity of modern radar systems. They're available to cover the non-wood frequency bands and come in a variety of mount configurations.

The series features a shielded cathode, low modulator drain, and field-replaceable tube insert. Rugged. Insensitive to a wide range of ambient temperatures. Compactly engineered for demanding air and ground environments. Economical because of replaceability, plus added advantages of logistic simplicity and ease of maintenance.

BIG FROM A SMALL NOISE SOURCE

The tube pictured here is the single-sided L-2000 with the LR 2000 insert, specified for a recent generation of FAA airport surveillance radars and for a variety of well-known "S-band" military systems.

For more data on these or other precision gas tube products, write Litton Industries, Electron Tube Division, 960 Industrial Road, San Carlos, California. Or telephone EYT/11-18411.



GAS NOISE TUBES						
Tube Number	Gas Discharged	Electrode	Electrode	Minimum	Maximum	Max. Heating
L-2000	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2011	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2012	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2013	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2014	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2015	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2016	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2017	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2018	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2019	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2020	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2021	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2022	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2023	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
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L-2099	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2100	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2101	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2102	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
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L-2109	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2110	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2111	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
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L-2113	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
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L-2157	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2158	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2159	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2160	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2161	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2162	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2163	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2164	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2165	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2166	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2167	Argon	18.0 ± 0.1	18.0 ± 0.1	25	300	800
L-2168	Argon	18.0 ± 0.1				

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component packaging, are available in solution of glass, secondary rapid anneal, power ratings. One type, located in a 6 in. high, is suitable for mounting on substrate where substrates are stacked compactly on top of one another. Another form can be employed for efficient use of space on chassis. *Manufacture*, Dept. 2025, 2025 Farnham, Dallas 7, Tex.

• **Flanged solenoid** valves, CK 7994 and CK 7995, similar to larger model flange gear valves, will permit tight packaging of electronic gear. Both valves have low dead-space requirement between plunger and cathode plate holder, high transconductance to plate current ratio, low noise and low inter-electrode capacitance. The CK 7994 is a high frequency grounded grid triode; the CK 7995 is designed for use in a wide-band RF or IF amplifier. *Muskegon Raytheon Co., Industrial Components Division, 35 Chapel St., Newton 18, Mass.*



• **Transistorized servo amplifier**, Model 103A, which weighs 3 lb. and occupies 1 cu. ft. of space, can drive a 40-watt, two-phase servo motor up to 31° with rapid amplifier transient. Power requirement, operating at 400 cps over the temperate temperature range from -50°C to 115°C and is available in single-line, dual or triax mounting. Priced at \$1900 to \$2000 in sample quantities, the amplifier can be obtained on a 10-day delivery basis. *Muskegon Melcor Electronics Corp., 45 Toledo St., So. Farmingdale, N.Y.*



Could a Nader be born? The new U. S. Defense position, calling for an end to "Model & Done economy," is almost certain to obtain widespread support within our missile industry.

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Aerojet Proposes Segmented Boosters

By George Alexander

Washington — Multi-section, preassembled, solid propellant segmented space boosters could be built and could launch payloads within 18 to 24 months and comprise boosters with Saturn-type vehicles in cost and performance, Aerojet-General has told Defense Department, Air Force and National Aeronautics and Space Administration.

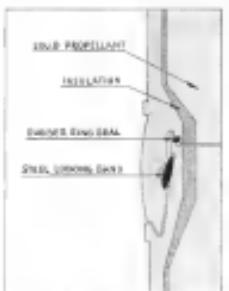
Segments would be stacked or clustered in varying lengths and can be assembled to produce any desired boost level, consisting of:

- Four stages, 72 in. long, 108 in. in diameter and filled with 17,000 lb. of propellant.

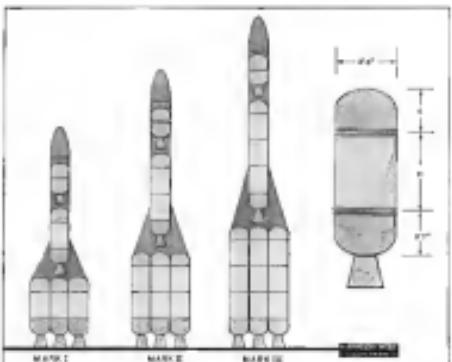
- Cluster section 112 in. long, 108 in. in diameter and filled with 15,000 lb. of propellant.

- AH cluster, 79 in. long, 108 in. in diameter and filled with 17,000 lb. of propellant.

Segments are jettisoned and sealed by a lock-strip joint (see sketch) and secured by three flexible steel rods in seated at three apertures in the outer circumference of the joint. Aesthet of two units, using an igniter, takes less than two minutes, Aerojet said.



LOCK-STRIP joint and seal developed by Aerojet-General for its segmented rocket program allows assembly of two units in two minutes. Units are jettisoned and then steel rods are introduced through the cluster seal gates to lock the units. Rubber O-ring gaskets fit the base of each metal and ceramic portion of the link, provides gas leakage.



SEGMENTED MOTORS (right) proposed by Aerojet to Defense Department, USAF and NASA consist of three standard building blocks (left), ready and set closely and can be assembled in varying lengths and configurations to provide any desired boost. Mark I vehicle would stand 18 ft. tall, weigh 419,600 lb. in launch and could lift 10,000 lb. payload. Mark II would be 109 ft. high, weigh 912,800 lb. in lift-off and carry a 10,000 lb. payload in low earth orbit. Mark III would stand 131 ft. tall, weigh 1,313,800 lb. in launch and could place 25,700 lb. into earth orbit.

Propellant would be primarily available polyurethane, aluminum and ammonium perchlorate fuel, with a specific impulse of 245 sec. Aerojet said that the diameter to use for propellant per payload energy level approaches the optimum trade-off between performance and cost. It would run about \$1 per pound.

Total impulse

Total impulse of a three-segment motor 50% volumetrically loaded and with a mass fraction of 95%, would be 30,000 lb.-sec. Thrust would vary with burning time: 2 million lb. at 10 sec., 300,000 lb. at 60 sec. and 550,000 lb. at 60 sec.

Aerojet described three all-solid rocket boosters to the military and civilian agencies: Mark I, II and III. The Mark I, consisting of three complete boosters, center and all actuator motor, is a cluster in the booster, one complete motor in the second stage and a boost and cluster assembled to form the third

stage, could put 15,000 lb. in a 100 nautical mile orbit. The Mark II could put 19,000 lb. in identical orbit, using an outer section in the booster in cluster of three stacks, two units to a stack plus head and cluster, two units in second stage and a third stage similar to that of Mark I.

The Mark III could lift 25,700 lb. into the same orbit using same outer sections in cluster of three stacks, three units in a stack, plus head and cluster and with burning time: 2 million lb. at 10 sec., 300,000 lb. at 60 sec. and 550,000 lb. at 60 sec.

Of the various types of thrust vector control system tested, Aerojet reported that the most promising approach appeared to be liquid injection (AW Mar. 18, p. 53), where a fluid is introduced in the gas stream along one side of the nozzle wall to produce an oblique shock wave.

If 30 to 40 vehicles are ordered, Aero-



Everything the enemy says
will be used against him

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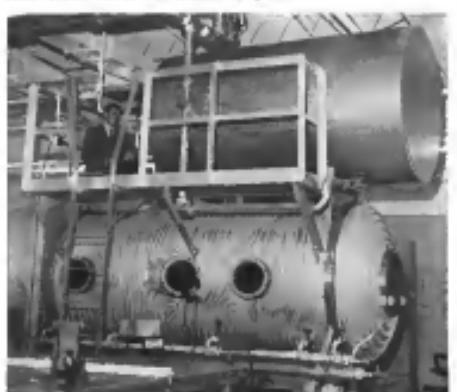
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not economical that the cost would run about \$2 per lb. of rocket. The longer the size of the rocket the more cost would be present. A 5 million lb thrust booster could be built for about \$1 million.

Going to larger, 140-m diameter tanks, Argent stated, would result in much greater performance, while the only modest cost increase. A booster consisting of 140-m diameter tanks could place payloads in orbit for about \$100 per lb of payload compared with the \$400-\$700 per payload it now costs for Boeing.

Although Argent proposed 100-m diameter tanks for the first launch, he said 200-m, that is, four 50-m tanks could be tested but within 50 months. A cluster of 24 100-m tanks would be either a cluster of four 100-m diameter tanks, or a single 140-m diameter tank.

This system could lift 45,000 lb into earth orbit or 16,700 lb into



100-M ENGINES designed and produced by Rockford will be tested in this vacuum tank in company's new Electrical Propulsion Laboratory. Tank, 60 feet in diameter and 12-ft long, is larger of two in laboratory. It can be used to test one engine up to 1/6th thrust.

Ion Engine Laboratory Completed

Laboratory for development and test of electrical propulsion engines has been completed at Rockford Division of North American Aviation, Inc., Glendale Park, Calif.

The Electrical Propulsion Laboratory, which is space simulating, vacuum sealed and will provide enough research

and development facilities, are jet and solid thrust devices and propellant feed lines, controls and instrumentation.

Also integrated into the laboratory are eight huge power units which provide a direct current power output totaling 800 kw, and an electrolytic tank circulator.

Soviets Describe Tests Given to Space Dogs

Soviet—Russian space economists are managers which conduct short one-day or two-day training and conditioning before flight into space, the Soviet press reports.

A Tass writer who visited the vertebrate laboratory, where the animals are housed and cared for reported these tests:

• All four dogs selected from space dogs for the first Sputnik, Chernobyl and Zvezdochka—were matched with age, weight and sex, and each had a similar flight record of 150-160 kg. In each case, the dog was in a deep space probe. The Lunik 1A rocket could be lifted by either a cluster of four 100-m diameter tanks, or a single 140-m diameter tank.

This system could lift 45,000 lb into earth orbit or 16,700 lb into

space.

• In order to teach the space-dog candidates to live in a restricted space, they are first put in a small cell, then placed in longer and longer periods into in increasingly smaller cages. The last of the cages is the same size as a rocket capsule.

• Dogs must become accustomed to wearing space garments—these which are not yet described. The Soviets are their home aboard the rocket if the garments are fitted closely.

• Space-dog candidates at first receive only standard food as porridge, meat and bones but "shortly before flight the dogs are put in a special ration which is mixed by an automatic device. At first the automatic feeder operates and then begins some days before flight offered to the dog certain all-nutritive nutritive substances and water is given to ascertain that article drives receptors.

• To test and condition the embryo to space flight conditions they are placed in thermal chambers to determine their resistance to high temperatures. "At first the dog urinates often, then as the temperature rises it begins to urinate more frequently, and in open mouth, breathing heavily via鼻, but, gradually, the temperature is lowered and the test brought to an end. The animal is then released and allowed food and water."

The dogs become accustomed to certain garments used in a stratosphere. Special tests are made to determine their resistance to temperature, oxygen, changes in pressure, rocket engine noise and other unusual rocket conditions.

"Scientific inference of a dog's reactions to this is that it influences processes different from that of man. But scientists know how to make allowances for peculiarities of the human organism. This experiment with vertebrates provides scientists with information which serves as a point of departure in working out measures to ensure the safety of manned flight into space."

Space Vehicle Log

(As of April 1, 1961)

Satellite or Vehicle	Name	Launch	Launch	Period	Range	Parcels	Transmissions ¹	Transmissions ¹	Estimated
		Date	Locality	Sec.	Dist.	Sec. No.	Prog. No. 1	Prog. No. 2	Lifetime
1958 Alpha	Explorer 1	01	1 Feb	166.4	1300	396	166-366-63		7-14 yrs.
1958 Beta 1	Rocket Body	05	17 Mar	116.4	3800	400	166-371		1961-1968 yrs.
1958 Beta 2		05	17 Mar	116.4	3800	447	166-371		1961-1968 yrs.
1958 Gamma 1	Vanguard 1	09	17 Mar	116.3	3200	263	166-366-63		1961-1968 yrs.
1958 Gamma 2		09	17 Mar	116.3	3200	268	166-366-63		1961-1968 yrs.
1958 Alpha 3	Rocket Body	05	17 Mar	116.3	2950	368	166-371		1961-1968 yrs.
1958 Delta	Explorer 10	05	7 Aug	21	Prob. the Moon	166-31-119-19			
1958 Gamma 3	Rocket Body	05	17 Mar	116.3	2950	368	166-366-63		1961-1968 yrs.
1958 Delta 1	Rocket Body	05	17 Oct	116.6	640	945	166-371		1961-1968 yrs.
1958 Delta 2	Rocket Body	05	17 Oct	116.6	640	420	166-371		1961-1968 yrs.
1958 Delta 3	Rocket Body	05	17 Oct	116.6	640	420	166-371		1961-1968 yrs.
1958 Gamma 4	Rocket Body	05	17 Oct	116.6	640	420	166-371		1961-1968 yrs.
1958 Gamma 5	Rocket Body	05	17 Oct	116.6	640	420	166-371		1961-1968 yrs.
1958 Gamma 6	Rocket Body	05	17 Oct	116.6	640	420	166-371		1961-1968 yrs.
1958 Gamma 7	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 8	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 9	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 10	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 11	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 12	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 13	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 14	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 15	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 16	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 17	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 18	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 19	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 20	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 21	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 22	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 23	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 24	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 25	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 26	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 27	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 28	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 29	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 30	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 31	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 32	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 33	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 34	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 35	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 36	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 37	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 38	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 39	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 40	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 41	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 42	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 43	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 44	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 45	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 46	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 47	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 48	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 49	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 50	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 51	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 52	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 53	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 54	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 55	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 56	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 57	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 58	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 59	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 60	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 61	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 62	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 63	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 64	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 65	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 66	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 67	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 68	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 69	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 70	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 71	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 72	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 73	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 74	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 75	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 76	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 77	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 78	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 79	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 80	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 81	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 82	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 83	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 84	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 85	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 86	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 87	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 88	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 89	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 90	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 91	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 92	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 93	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 94	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 95	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 96	Rocket Body	05	17 Oct	116.6	640	176	166-371		1961-1968 yrs.
1958 Gamma 97	Rocket Body	05	17 Oct	116.6	640	176</			

NEW DEPARTURES IN MINIATURE



A SIGNIFICANT "BEARING" ON TERRIER GUIDANCE

N/D MINIATURE AND INSTRUMENT BALL BEARINGS HELP SOLVE COST PROBLEM IN SUPERSONIC MISSILE

PROBLEM: Guidance system in Terrier missile required miniature and instrument ball bearings that help reduce high cost of assembly and meet rigid reliability standards.

SOLUTION: N/D Beloit Engineers, consulting with the Iron Fyrestone Manufacturing Company, recommended the use of Flanged Instrument ball bearings in the gyro rotor and the outer gimbal positions. Result: Flanged bearings simplified both bearings and resulted in substantial assembly cost savings. Moreover, a N/D reference ball bearing, similar to the bearing picture between inner race ... is used in the gyro caging case. It also has a vital "bearing" on the Terrier's reliability and performance.

Furthermore, numerous tests in New Departure's R & D facilities proved the bearings to be capable of meeting all environmental demands before gyro production changes were made.

If you would like Miniature/Instrument ball bearing application assistance, please write the N/D Beloit Engineer in your area to participate in your early design discussions. He may point the way to assembly cost savings. Or, call or write New Departure, Division of General Motors Corporation, Bristol, Connecticut. Write for folder—Aviation 1970 Design Engineering Show May 16-18, 1970, at 44 Hill Street, New York, N.Y. 10013.



Send for the New Departure
Miniature and Instrument
Ball Bearing Catalog and
White Room Brochure today.
Write to Department L-5
New Departure, Division of General Motors Corporation, Bristol, Connecticut.

NEW DEPARTURE
MINIATURE AND INSTRUMENT BALL BEARINGS

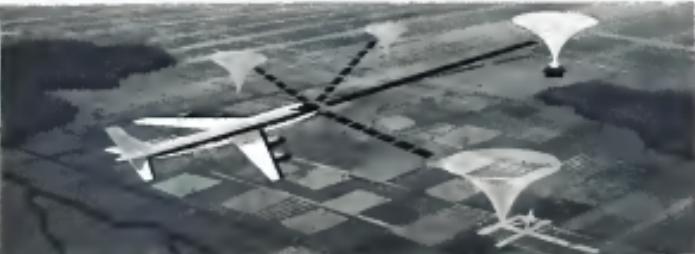
Hawker P.1127 NATO Entry Conventionally Flown

Hawker P.1127 VTOL fighter, powered by a Bristol Siddeley BS 55, delivered the warbird with a drag chaser wing approximating 15,300 lb., as shown in free flight as wheels spread full month lips for the engine air intakes appear to be lowered. Under the British NATO entry, completed hovering trials (AW Dec. 5, p. 35). Wingspan is 24 ft. 4 in. Conventional intakes are fitted for lateral control during non-hoovering flight. Landing gear is twin tandem configuration, with two main wheels off center of gravity and single conventional forward





1 HOLDING PATTERN PROGRAMMER: Programs Adelphos II flight Control System to fly prescribed holding patterns, automatically correcting for wind.



2 VORTAC COMPUTER: Through electronic computer, creates phantom VORTAC station which is needed for precise routing through congested areas and for direct flight navigation to destination with limited navigation facilities. Provides constant readout of bearing and distance information.

TRAFFIC CONTROL OF COMMERCIAL, MILITARY, AND BUSINESS AIRCRAFT TO BENEFIT FROM THESE 7 MODERN BENDIX AIRBORNE DEVICES

4 TO-FROM BEEPER: Gives audible signal during VHF station crossing, on all laser intersections, warning pilot of being instrument concentrated.

5 AUDIO CO PILOT: An experiment in converting infrared flight warnings and selected flight data to audio signals (e.g., calling out "ZEROMIN" and take off" while pilot is



Knowmanship in Action

Since introducing the "Earth Infactor" compass in aviation's early days, Eclipse-Pioneer has been responsible for a wide array of control and navigation equipment that has anticipated aviation's ever-growing, ever-changing needs. All seven devices shown on these pages are important new advances designed to solve problems and ready to aid in achieving the exacting precision of navigation and traffic control.

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For further information, write to:

Eclipse-Pioneer Division

700000 N.E.



6 SIGNAL COMPARATOR: Compares signals from two like systems (i.e., horizon, compass, gyro systems) and warns when differences exist.



7 TWO-AXIS GYRO MONITOR: Warns when gyro is not erected to vertical. When used with a Signal Comparator in a dual system, tells which gyro is malfunctioning.

Shipments of Civilian Aircraft and Engines

Item	Shipments 1981 (\$ mil.)	Shipments 1980 (\$ mil.)
Biplane aircraft, number	107	100
Flying-wing	107	100
Multi-engine	111	101
20 planes and under	56	51
21 planes and over	55	50
Prop. engine	67	60
4 planes and under	133	120
5 planes and over	56	50
Rotary-wing	14	14
With 100 percent of civilian aircraft and 20 percent	31,000	31,000
of military	31,000	31,000
of aircraft	31,000	31,000
of aircraft, total aircraft weight	1,000 lb.	1,000 lb.
Floater-wing	500	500
20 planes and under	500	500
21 planes and over	500	500
Rotocraft	102	100
Number of aircraft engines and engine sets	14,000	14,000
of aircraft	14,000	14,000
of aircraft engines (including hydrofoils, air-buoyancy, air-buoyancy, and balloons)	12,000	12,000
of aircraft engines sets	12,000	12,000

Source: National Safety Council. Totals for aircraft weight and over unrounded to \$100 of the total of February 1981, and \$100 at the end of January 1980.

PRODUCTION BRIEFING

Minneapolis-Honeywell. Regulator Co. will develop the secondary attitude reference subsystem for the Delta-Satellite space glider under a multi-year dollar-lot Air Force contract. The subsystem will serve as a backup and monitor for the primary guidance subsystem.

Aerospace-General Corp. has received a \$500,000 initial engine research grant from the Air Force. Aerospace is preparing preliminary design criteria for a medium propulsion system ranging from the upper stage thrust levels to medium-class power thrust boosters. The work also will provide design input requirements, feasibility studies and cost associated with the design.

Aerospace Division of the Corlett Corp. will design and manufacture the air conditioning system for the 727 jet under a multi-million dollar contract from Boeing Airplane Co.

Five major companies have formed a Mobile Rocket Services Inc. (Mobile) team to bid group to provide management and technical support for the activation and maintenance of mobile base and launching facilities for aerospace Atlas, Titan and Mach-2 intercontinental ballistic missiles. The companies are Blue Water Corp., Del E. Webb Corp., Halcrow Corp., Northern Electric Corp. and Scott Co.

96

missions in the stratosphere for periods of time within tolerances of one or two thousandths of an inch.

B. F. Goodrich Aerospace Products, Napa, Calif. will install a liquid-cooled brake system on United Air Lines Boeing 720 jet transports. The brakes incorporate a liquid-to-liquid heat exchanger to keep temperatures below 50°F.

Link Divisons of General Precision, Inc. has been awarded two Air Force contracts totaling more than \$6 mil. for delivery of C-130 flight simulators and development and manufacture of visual simulator trainer attachments.

Lockheed Corp. has been awarded two contracts totaling \$12.3 million by Contractor Division of General Dynamics Corp., prime contractor for the B-52 Flying Wing, for \$2.1 million in in-build control systems for an advanced aircraft, measuring 56.3 inches, to be produced in conversion of previously built B-58s to permit tactical configuration and modification of four of the aircraft in training.

Electro-Optical Systems, Inc., Inc. received two NASA contracts for analysis of test evaluating performance of electrostatic propulsion systems in space (3115,160) and for summer development and surface plasma studies (374,945), including experimental research and development of porous tungsten ion emitters.

Thiokol Chemical Corp.'s Longhorn Division has received a \$4,934,352 contract from the Army for final assembly and loading of various missile motors. Changes also are being made at the Longhorn plant to permit production of the Pershing propulsive motors.

Bellini Corp. will make five additional replacement systems for launching Minnesota results rate underground launch tubes. Boeing Airplane Co. will manage the contract worth nearly \$1 million.

Boeing Co. has received contracts totaling \$56,584,827 from the Boston Ordnance District for research, development, engineering and field service work on the Black smoke filter.

GE's Light Military Electronics Dept. has received a \$175,000 contract for design and development of an electrostatic precipitator for use in aerospace. California Institute of Technology's Jet Propulsion Laboratory, a NASA research facility, awarded the contract.



UNITED TECHNOLOGY CORPORATION DEDICATES NEW ROCKET PROPULSION COMPLEX NEAR SAN FRANCISCO

Photo was taken from an in-ground
crane used to move the rocket
nozzles at UTC Development Center.
This particular oven is the largest
in the free world.



AERIAL VIEW of UTC Research and Engineering Center in Sunnyvale, California, shows Adminstrative and Engineering Buildings and Research and Testing Laboratories.

UNITED TECHNOLOGY CORPORATION FACILITY PROVIDES CAPACITY FOR DEVELOPMENT AND TEST OF BIGGEST U.S. SOLID PROPELLANT ROCKETS

Dedication of privately-financed installation is significant milestone in 41-year history of pioneer propulsion organization

With work well underway on a broad range of propulsion research and development activities, United Technology Corporation has officially dedicated its new facility in the San Francisco Bay Area.

Here all the necessary equipment and facilities for basic research, prototype evaluation, final development, and processing of solid and liquid rockets have been integrated into a modern, functional complex.

The photos here give some indications of the capacity of these facilities.

Highly skilled and experienced scientists and engineers are conducting a full range of propulsion research and development activities at UTC's new installation.



VIEW OF ENTRANCE to the 3,200 acre Development Center, located in foothills a short distance from Sunnyvale, which includes the world's most modern propellant processing plant and test facilities for both solid and liquid rockets.



UTC'S SOLID-PROPELLANT MANUFACTURING PLANT has capacity to produce in excess of a million pounds of propellant per month.

HUGE PROPELLANT MINE is one of four included in UTC processing line.

COVERING TEST STAND at the Development Center will accommodate very large solid rockets. In addition, four medium-sized solid rocket test stands and two liquid propellant test stands are available for developmental work. Each is connected to a remote control center which houses equipment for test control and data acquisition.



Depotly backed by four decades of precision aerospace

UNITED TECHNOLOGY CORPORATION
A subsidiary of United Aircraft Corporation
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Larger Version of Communaute Proposed

By Robert E. Farrell

Pane-Dumont and Sud Aviation have sold up their common light transport project, the A15 Communaute, and now are seeking government financial support before launching production of the new subcompact four-engine aircraft.

French Civil Aviation Ministry, whose budget will have to be tapped to cover anticipated cost, the Super Transport, and would be the only French light transport project to seek a government support at the favourable time. Therefore, observers, therefore, are doubtful that the money-shy Ministry, which already has pledged over \$2 million into the Mar. Hélico-Nord Aviation feeder project, the Super Transport, will solvent in position and finance a second light transport.

Reportedly, Dumont and Sud initially are asking for close to \$12 million to finance two prototypes, tooling and testing. Without the government backing, it is noted, the Communaute would not carry out its joint project. To assist the project, however, Frenchman, Ben Peyton, president of Turbo Flight, Inc., Chicago, has which would sell the Communaute in the U.S., recently came to Paris to urge government backing. Turbo Flight reportedly has agreed to purchase one of the \$400,000 aircraft as soon as production gets under way. This aircraft would be used for demonstration purposes in the U.S., where Peyton believes an untrapped market exists for an aircraft in the category of the Communaute.

The Turbo Flight president is asked to agree to a four-year letter of intent to buy 12 U.S. aircraft and two test pilots. The pilots will flight-test the single-engine prototype of the A15 Communaute.

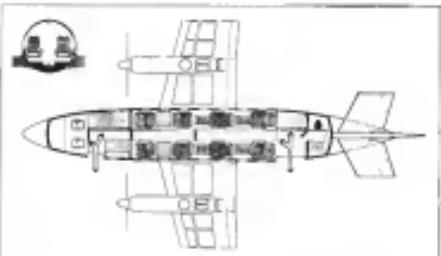
The single prototype, however, is smaller than the six Communaute version. Later, originally designated Communaute A1, now bears the name, "Dupleon." Expected price of the new version is about \$400,000.

If French Civil Aviation Ministry backing is not forthcoming, Turbo Flight says it will take financial responsibility for the aircraft. The smaller model, however, that certain orders will be granted to partly fill an order.

Dupleon is a scaling-up extrapolation of the Communaute. 1/4th the size of the latter. Preliminary figures show that gross weight of the new version is 16,940 lb compared with 15,415 lb for the smaller Communaute. Dupleon, like the Communaute, will be powered by two Turbomeca Bastan turboprops of 1,300 shp each.



PLAN VIEW of Dupleon Communaute A1 is superimposed on drawing of Douglas DC-3.



EXECUTIVE version of Dupleon has eight passenger seats, two work tables.

Aircraft will be offered essentially in the following three versions:

- Executive: Eight passengers can be seated in comfortable armchair-type seats with two working tables arranged forward. A 56-cu ft compartment is located at the rear of the cabin and a 35-cu ft compartment is available forward.

- Transport: In several cabin configurations, 21 passengers are seated in seven rows of double seats on one side, single on the other. It is possible to outfit an additional row of three seats forward, housing total passenger capacity in 24. In the smaller Communaute version, passenger capacity was 12.

- Passenger: The interior of the Dupleon could be earned out in the following manner:

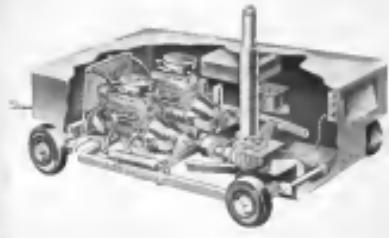
With eight passengers plus two crew, Dupleon takes off at 16,500 lb and cruises 1,600 mph at 20,000 ft. In level flight at 15,000 ft, Mach speed of 251 mph, or 2.34 M. Max. Range position of flight, four hours at normal fuel

at 2,000-mph airspeed is available in the cabin rear. Axle width is 1 ft 6 in, seat spacing is 32 in. Height from seated sole to cabin ceiling is roughly as low. There are eight Communaute windows on each side of the cabin.

- Cargo or air/air: Cabin space at 960 cu ft presents several cargo or cargo-passenger arrangements.

- Passenger: The interior of the Dupleon could be earned out in the following manner:

With eight passengers plus two crew, Dupleon takes off at 16,500 lb and cruises 1,600 mph at 20,000 ft. In level flight at 15,000 ft, Mach speed of 251 mph, or 2.34 M. Max. Range position of flight, four hours at normal fuel

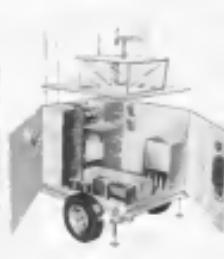


FOR THE MAINTENANCE PROGRAM—An instrument testing pack. Delivers 2500W in air at 32°F, and 2500W for R & D testing.

FOR THE REPAIR I PROGRAM—An instrument testing pack simultaneously tests and checks performance control gear in more than 200 sections of the engine while on the site.

FOR AN ADVANCED TURBOPROP ENGINE—A new mobile power system. Operates directly with engine's generator. Offers a wide range of starting torque and speeds.

FOR AN ADVANCED FALCON MISSILE—An automatic liquid booster. Checks heat sink electronic components during ground checkout.



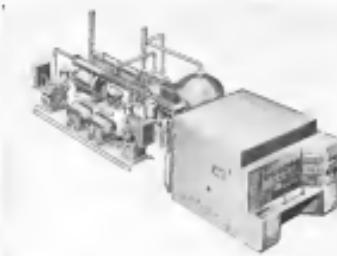
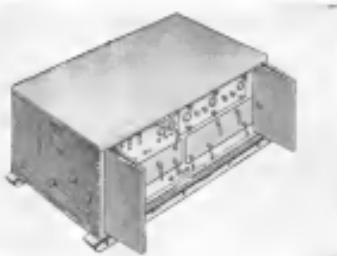
FOR THE NAVY T-34 & T-64 ENGINES—A reversible per cent control test stand. Supplies fuel flows up to 6,500 lbs/hr at 1,500 psig. Has controllability for Fuel Temperature Range from -65 to +330°F, accurate to ±1°F.

FOR THE F-104—A simulator of 1500 ft/min. 100 sec. climb rate. Checks to insures 60% of the present temperature control components.

FOR THE AIR FORCE AND NAVY—A propeller open-chamber test stand for 2- and 4-engine aircraft.

FOR T-40A—A portable air traffic control tower. Features ignition, radio and weather equipment.

Two facts you should know about this GSE



FOR THE TITAN II PROGRAM—A pumping and metering unit for transfer of propellant test cast sections.

FOR THE F-104—A pneumatic test stand. Simulates flight conditions to simultaneously check the plane's air-conditioning system during ground

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Skybolt launching pad.

Any piece of sky can be the launching pad for Skybolt air launched ballistic missile. This radically new deterrent weapon is designed to have global mobility. It will be carried, and launched in flight, by the USAF B-52, or RAF Valcon. When it becomes operational, four Skybolts may be launched from the same B-52 to strike multiple targets up to 1000 miles away. The very existence of such a flexible retaliatory force will be a formidable deterrent.

The stellar-monitored inertial guidance system for the USAF-Douglas Skybolt is being developed and built by Northrop.

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EQUIPMENT

NATO F-104 to Use Compact Photo Unit

By Barry Tolly

New York—Photo reconnaissance units for North Atlantic Treaty Organization tactical aircraft, designed to maximize the external fuel tanks of the Republic F-104, will be modified for a fuselage installation on NATO Lockheed F-104 fighters.

Severe space limitations of the fuel tank led to the KS-65A photo system employing 70 mm format cameras with a fast (1/4,000 sec) shutter speed.

Development of the compact photographic system stemmed from the need for an aerial reconnaissance package for the F-104. To provide this plane maximum maneuverability without extensive modification to the aircraft, the fuel tank status was developed. At MacDonnell, Long Island City, N.Y., developed a camera system with the Air Force, which incorporates fast 70 mm roll film cameras.

Carrying the first of four external fuel tank, the camera system reduces fuel tank capacity by 25%. The installation requires minimal performance only in that range is reduced slightly and, of course, the fuel tanks must be removed. Additionally, the system is designed for installation in place without extensive photo system framing and has simplified engine controls.

Flight tests of the KS-65A camera system, installed on the right external fuel tank of an Air Force F-104, were conducted last December at Brookley AFB, Mobile, Ala. Included in the flight test was some maximum speed run down at an absolute altitude of 100 ft and at a speed of 550 ft. Higher runs were made up to an altitude of 30,000 ft.

The F-104 external tank camera is mounted within four of the 70 mm fuel canisters in a left oblique, right oblique, and two split vertical configuration. Interchangeable lenses may be fitted with focal lengths of 1.5, 3, 5, and 6 in. Camera weight varies slightly, with the 3-in. fitted. However, it is about 8 lb.

A focal plane shutter is employed which may be monostich at prior to flight for 1/900, 1/1,000, 1/2,000 or 1/4,000 sec shutter speed. The intrinsic exposure control system consists of a 0.05-L. C. line of light among elements and a photometer and a sensor photodiode. Hold-back potentiometer and motor drive circuitry has operating range is from 1/2.0 to 4/16. The entire



ROCKLEY AFB, ALA. A photograph of a city taken at 6,000 ft using the KS-65A light vertical photo unit taken by a KS-65A camera system of cluster setting of 1/4,000, 1/4 sec shutter speed. 16 mm lens. Building (bottom) was photographed by the 70 mm format system with standard shutter setting lens on F-104 at 100 ft. at 100 ft. absolute altitude.





Sifting sounds from the sea

Lockheed Electronics signal processing equipment to aid airborne sub-hunters

Detecting sound from a distant submarine out of the noise of the sea is as tough as hearing a bumblebee above the roar of a jet engine. The sub can lurk within range of a tracking sonobuoy, yet still not be discovered by the ASW aircraft. The general noise level of the running sea—the motion of waves, the rumble of ships or the squall of porpoises, for instance—may mask the faint target signal.

To fit the target signal out of the noise, Lockheed Electronics is developing airborne detection and locating equipment utilizing advanced signal processing techniques. These techniques hinge on modern information theory and noise theory—disciplines employed in optimizing the design of filters, detection, time regulators and computers to gain improved signal-to-noise ratios.

Lockheed Aircraft, LEC's parent company, has a notable record of achievement in ASW systems. These capabilities are now augmented by the talents of Lockheed Electronics, applied to underwater warfare components and systems.

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LOCKHEED
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Plainfield, New Jersey

OBJECTIVE:

TANTALYTIC® CAPACITORS 99.999% PERFECT

L. W. Foster, Manager of General Electric's Tantalytic Capacitor High Reliability Program, discusses a new unique data-system approach to achieve .001% failure rate per 1000 hours.

December of this year will mark the successful completion of General Electric's continuing program to achieve a 100% capacitor failure rate of 9013 per 1000 hours under specified test conditions. This achievement will stand out in contrast to numerous reliability claims because of the unique approach used to attain it, and the extensive test methods used to prove it.

GE's unique program recognizes limitations of "reliability testing"—emphasizes instead that reliability must be built-in! To build it in is to measure all critical variables. GE's Integrated Reliability Data System does this with its complex of needs and computers that weigh every factor from incoming material to field performance.

Once all variables are isolated, corrective action eliminates weaknesses. Action is often drastic and costly: a new chemical process . . . designing a new testing machine . . . or adding a new QC check at a key stage. This is the price of reliability.

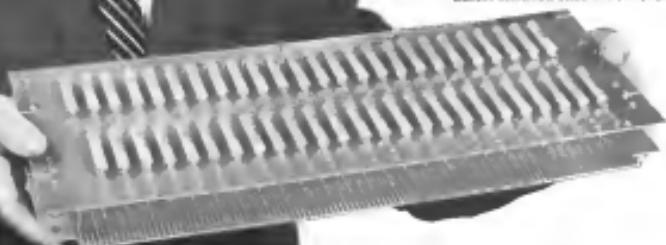
AC and DC Marine Test Programs then call for testing hundreds of thousands of capacitors under various temperature and voltage combinations—some for as long as three years.

And the cycle repeats: more corrective action, more feedback, more testing and a lower failure rate, with correspondingly higher confidence levels—the payoff of excessive reliability for critical elements. For data and specific proposals on our fast and solid Tantalum capacitor programs, contact your G-E Sales Engineer. Or write High Reliability Components, Marine and General Shunters Co., Inc., 2000 High Ridge Road, Stamford, Connecticut 06904.

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REVIEW ARTICLE: *Handbook of Second-Order Dynamics*



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Inertial Guidance for Maes, T-38s and T-45s. Navigation Systems for the B-52 and B-47.



RAF's First Armstrong Whitworth C Mk.1 Argosy

Armstrong Whitworth's first C Mk.1 Argosy transport for Royal Air Force differs from the AW 650 in that it has a nose volume, a supply cargo's window below the cockpit, and a cargo over cargo hatch, shown open, which is below the rear's window. Note vortex generators off of cockpit window. The military Argosy has "assault gun" cargo doors at the fuselage rear which have been sprung and closed as flight AW 650 has closed-out doors.

which was a nose down reported crash.

He considered a lower cruise for descending below the maximum flight altitude, but most have taken the easy way to increase over the usual weather in. Findings revealed just before commencing the approach was much lower. While the aircraft altitude was low, the aircraft was in a steep turn and visibility and the absence of significant head winds and light front reflections could strands have affected the possibility for a corrective maneuver.

The approach was presented as MDH approach, and the aircraft was on the east end of the runway to the north of approach. The heading of the aircraft at the last impact is not known but the pressure altimeter indicated both on board and at the search appear to have been decreasing subsequently.

It should be noted that the AW 650 was reported to have been flying at a very low altitude, from high level, with a but pitiful result. It is believed a different type of approach is that the more sensible for cockpit procedures is being on down. The first of the following will be considered as added consideration. At the time of the accident, it was not seriously recognized that special training in these approach after steep descent from high level might impair part of the training program for jet aircraft as the crew had not received such training.

An NDB approach is based on a landing extension from one or more approach air lines but the altitude and rate of descent of the aircraft are controlled exclusively through the barometric altimeter and the vertical speed indicator (rate of climb indicated).

After passing Atlanta Range (ANR) the aircraft, due to the changing road resistance was forced to make a turn instead of flying straight and straight.¹ This causes the rate of climb to reduce the approach during the cycling rates of the rate of climb and then begin the climb.

The technical investigation has revealed that the control handling system were mismatched ON position at the time of the first impact and is quite possible that on set, running out equivalent climb after passage of ANR.

This requires a retarding of the power lever, higher power being needed and that may have caused a fuel center running.

It is believed that the aircraft passed ANR at an altitude of 8,500 ft. The landing altitude reported to the tower and a probable altitude, and most therefore have occurred at 8,500 ft.

Under the prevailing circumstances of high altitude, a landing error of 1,000 ft may have been made in the error, but not stated. Such error is known to have been committed during flight training at the maximum altitude of 10,000 ft.

The may last approach attempt with the aircraft, made one minute before and at the end of ANR, was route message and no difficulties whatever were reported and it would therefore be assumed that the new intended to maintain the approach altitude. The aircraft was flying at a very low altitude, and the crew was informed that they could have a severe pass to passing ANR.

The investigation revealed that the wing flap was dropped during extension in a position of 9.12°. It was noted that this happened in a turn and with the feet on the port. If no flap was selected 9.12 set prior to impact.

It is known that the speed brakes were deployed and the crew chose engine under power. The aircraft was flying at a very low altitude in a nose down attitude.

This would indicate that a few seconds prior to the first impact, as serious technical difficulties had been experienced by the crew, as could with doors have been increased in much as to cause the aircraft to nosedive.

On the other hand, the flap might have come to a stop shortly prior to the impact, the cause being a hydraulic failure in the power hydraulic system. Assuming that having been the case the crew would have seen a large pressure warning, which would have been in added concern. However, no evidence of such failure has been presented.

In connection with the investigation, the crew have reported that control lever equipment in the cockpit under seat with special concern shows that both the control column in normal or flight-like was three power. Therefore, the possibility cannot be pre-

cluded that such blocking did in fact take place.

The possibility of a transverse malfunction of one of the servoservos cannot therefore be precluded, but must be considered remote.

Experiments carried out with other Cessna 172s have shown that a strong observer or smoke in the cockpit due to failure of the red hydraulic power system can be eliminated as pilot competence for the new. The aircraft, if it has been provided with such a feature, it has not been provided by the manufacturer to support the theory of such failures.

Conclusion

The Stoddard investigation group has arrived at the following potential causes:

- The aircraft was maintained, loaded,派遣ed and operated in accordance with valid instructions.
- The crew were duly licensed and trained.
- Flight crew fatigue or illness was not a contributing factor.
- The aircraft was maintained in accordance with the flight crew instructions.
- The communication between the aircraft and the ground stations was normal, well no technical defects or other trouble were reported.

■ The approach, however, and the aircraft reported ground approach was more appropriate than the earlier instructions recommended at the crash site.

■ The workload as the cockpit was high during final approach, the normal landing being a 10-second task, the descent, the landing of 10 seconds, the takeoff, etc., and the fact that the landing clearance after passage of the map station was always given "straight on" in "Nosehigh".

■ There was no disorientation in the air.

- At the time of impact, the aircraft was correctly lined up for the approach, and the aircraft was flying straight and the speed brakes were locked and the speed brakes were locked.
- The wing flap was made extension and at the time of the impact, in a position of 9.12°.
- At the time of impact, the aircraft was 1100 ft below minimum flight altitude for



Said Gaspard de Coriolis: "A particle which is subject to no forces in a rotating coordinate system experiences a radial acceleration and a tangential acceleration."

It was around 1848 that Coriolis discovered what has since become known as the Coriolis Effect. He noticed objects above the earth tend to veer relative to the earth's rotation. To the right in the northern hemisphere, to the left in the southern.

The Coriolis Effect is a force in outer space, too. If a space vehicle is rotated in order to establish orbital gravity, the necessarily short radius of the rotation causes a Coriolis force. This creates orientation problems for a human occupant. To eliminate this difficulty, a scientist at Lockheed Missiles and Space Division conceived the idea of connecting the vehicle to an auxiliary fuel tank by a belt-drive cable. Thus, if the whole system is then rotated at a uniform speed around its center of mass gravity, the longer radius greatly minimizes the Coriolis force. Right now—an on the drawing boards at Lockheed—is an unusually advanced space attitude system which utilizes this concept, in addition to many others.

Fortunately, natural laws are about the only restrictions which dimension the scientists and engineers at Lockheed Missiles and Space Division. The climate in Sunnyvale and Palo Alto, on the San Francisco Peninsula, is close to perfection. The creative atmosphere—the opportunity to work on such important projects as the Discoverer and MIDAS satellites, the POLARIS, or even more advanced concepts such as the space station cited above—is the dream of the creative engineer.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-110, 999 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required. All position applicants will receive consideration for employment without regard to race, color or national origin.

Lockheed / MISSILES AND SPACE DIVISION

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS Programs
SUNNYVALE, PALO ALTO, YERK MUNI, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HANFORD

the actions in question, and 700 ft. below the landing position for the airport.

- No preburner shutoff was found, which could have been the primary cause of the accident.
- Examination of the primary flight control system revealed that the ailerons were screechable as found, but seven continuous control cycles, etc. was found inside the screech area.
- On the basis of the control analysis, the primary has screeched at the following:

The cause of the accident was the fact that the aircraft dived approach to Enewetak Airport descended below the recommended descent angle, thereby losing the rate of climb. The recommended descent angle is 6.5°, which is established due to lack of transition altitude.

However, in the course of the investigation it was found that a number of adverse conditions were encountered, each of which contributed to the accident. The primary cause of the accident was the failure to follow the minimum safe altitude.

Recommendations

Based upon this investigation it is recommended that:

- A minimum safe altitude maximum rate of descent should be established (Over 2,000 ft. above, then flight altitude + 2,000 ft.).
- The rate of the jet aircraft should receive special training in flight altitude approach.
- Standardized safe altitude approaches should be established at all airports with per operation, and relevant approach charts issued.
- ILS approach systems charts should be distributed as far as possible at all airports and all approach charts.
- At all airports where instruments, crews should receive special training in landing techniques.
- Instrument landing charts should be supplemented with publications regarding instrument test.
- The best possible working conditions should be established for the cockpit crews by keeping all hot gasses from entering from engine and cockpit and by insulating considerations in the cockpit in order to reduce crew fatigue.
- The minimum recommended of power flight instruments should be stand by fuel in order to reduce possibilities of loss.
- Aeronautical charts should be taken to eliminate the chance of miscalculations from the flight distance analysis.
- All procedures in Cessna aircraft should be checked and cleared.
- Modifications, changing the possibility of causing the control column should be checked.
- Modifications, changing the possibility of cables in the cockpit due to failure of the motor for the jet hydraulic pump should be considered.
- All aircraft altitude should be checked.

The crew should assess information on the power to use as early as possible the approach.

- General flight advice should be modified to prevent redundant electrical power loss.



THERE IS NO CEILING ON IDEAS

Advanced hydrogen systems being developed by The Garrett Corporation solve the problem of keeping man alive and equipment operating for long periods of time in future satellites and space capsules.

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- Aerospace Systems—Largest supplier of secondary power units. Allis-Transformer is also working with hydrazine, liquid and gas oxygen, and hydrogen systems for satellites, liquid and gas storage tanks and auxiliary ground support.
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AEROSPACE CORPORATION

WHO'S WHERE

(Continued from page 21)

Honors and Elections

United Aircraft Corp., East Hartford, Conn., has awarded an George Julian Medal for outstanding achievement in George Bassett Voronoff, president and founder of the Voronoff Standard Electrode, for his invention of the variable resistor principle, a new resistor in power design which places the burden in a function of temperature.

Mr. George O. Brown, Jr., has been elected the second honorary member of the Order of Dendrobium. Gen. Brown was honored as "The Father of American Math" in 1962.

Dr. Charles T. Goff, chief of the Life Sciences Division, National Bureau of Standards, Washington, D. C., has been appointed chairman of the Life Sciences Committee of the nation's Aerospace Medical Assn.

John B. Kelly, Duluth, Minn., has been elected the first Honorary Member of the International Academy of Astronautics.

Changes

John M. Hebbard, management engineer and project manager, General Electric Co.'s Aerospace Activities, Turbine Department, Louis, Mo., Eugene H. Howell, supervisor of Dr. Hebbard's management group, and Donald W. Poff, supervisor Mr. Howell's management group, have been promoted. Allen J. Rounding, supervisor Mr. Poff's management laboratory and test operation.

Dr. Charles F. Lindquist, an astrophysicist, protective equipment, for vital areas areas of the human body. He joined Nasa's Ames Research Center, Moffett Field, Calif., in 1960. Dr. Lindquist, assigned to the press department, Lockheed Corp., Sunnyvale, Calif., since 1962, has been promoted to manager of the Lockheed Washington D. C. office.

Edwin J. Gosselin, Jr., director, Office of Technical Information, Atomic Energy Commission, Washington, D. C. Edwin J. Gosselin, director, Defense procurement manager, the Morton Co., Denver (Colo.) Division.

Robert H. Hause, technical advisor to the chief of Aeromedical Design, Room 1E10, Wright-Patterson Air Force Base, Dayton, Ohio.

Donald M. Weston, director of research, TSCD, Board of Electronics Specialty Co., Los Angeles, Calif.

Barry Morris, regional director, Racing International Operations, office, Park, Florida.

Management Systems Management Division of Aerospace, a division of North American Aviation, Inc., Downey, Calif., has appointed the following program managers: M. D. Monguiro for production, T. E. McNeely for research and development.

Dr. Michael Paschalis, head of the Solid State Physics Section, Melpar, Inc., Palisades Park, N. J.

A. L. Brak, Jr., manager of the Walsh angular D. C. office of Aerostar Inc.

Edwin J. Brack, director of marketing, Raymond M. Storer, Inc., Los Angeles, Calif.

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RCA advanced military systems

Princeton, New Jersey

New beginning its third year, RCA's Advanced Military Systems organization is deeply involved in developing new systems concepts that will satisfy military requirements expected to arise later this decade.

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Members of the technical staff are relieved of administrative detail, and devote their time primarily to purely creative work. They are able to draw heavily on the most capable talents of other departments of RCA, particularly the operating divisions of Defense Electronics Products. In addition, specialists may be called in as needed.

These offices are in a new air-conditioned building on the spacious grounds of RCA's David Sarnoff Research Center. The community of Princeton, N. J. offers unique educational, cultural and civic advantages—and is conveniently close to New York City.

At this time, AMS is seeking a few senior theoretical scientists, engineers and mathematicians who have attained recognition in the fields of space or Plasma Applications. If you have at least 15 years of advanced education beyond bachelor's degree, if you are systems oriented and interested in working in an environment offering many opportunities and flexibility in use your creative and analytical skills to maximum advantage and at the highest level, we should like to hear from you. Write:

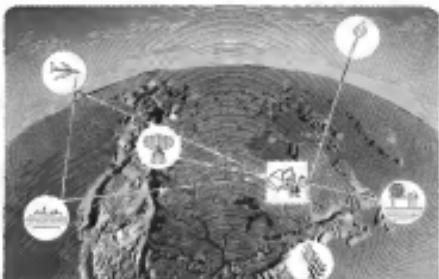
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Includes production scheduling, personnel, tooling and redesigning methods. Involves some design of various test and evaluation methods of rocket test facility. Requires experience in electrical, mechanical, environmental, chemical, thermal, mechanical, or chemical engineering.

• Orbital Engineering Required

Must complete courses in:

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2. Orbital Propulsion

3. Orbital Guidance

4. Orbital Control

5. Orbital Attitude Control

6. Orbital Navigation

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245. Orbital Attitude Control

246. Orbital Navigation



EARTH'S EYE TO THE SKY

Men have searched the sky for knowledge since history began. Each generation sees farther, learns more. But the human eye is reaching its limit—and there is still much more to know.

Radar astronomy can help. In Puerto Rico, the world's largest radar will send beams from an unusually powerful transmitter into a 1,000-foot wire mesh reflector, to bounce back out into space. The returning signals will extend man's "vision" by millions of miles.

Two Varian VA-842 klystrons will power the transmitter for this advanced USAF project. With each 2,000-microsecond pulse, these super-power tubes deliver 2.5 million watts at 430 megacycles. Write Tube Division for technical information.



VA-842
1.75 MW peak
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PALO ALTO 22 CALIFORNIA

Subsidiaries:

BOMAC LABORATORIES, INC.
VARIAN ASSOCIATES OF CANADA, LTD.
S-F-O LABORATORIES, INC.
SEMICON ASSOCIATES, INC.
SEMICON OF CALIFORNIA, INC.
VARIAN A.G. (SWITZERLAND)